SEPTEMBER 2004 ISSUE 157

Better Homes and Gardens®

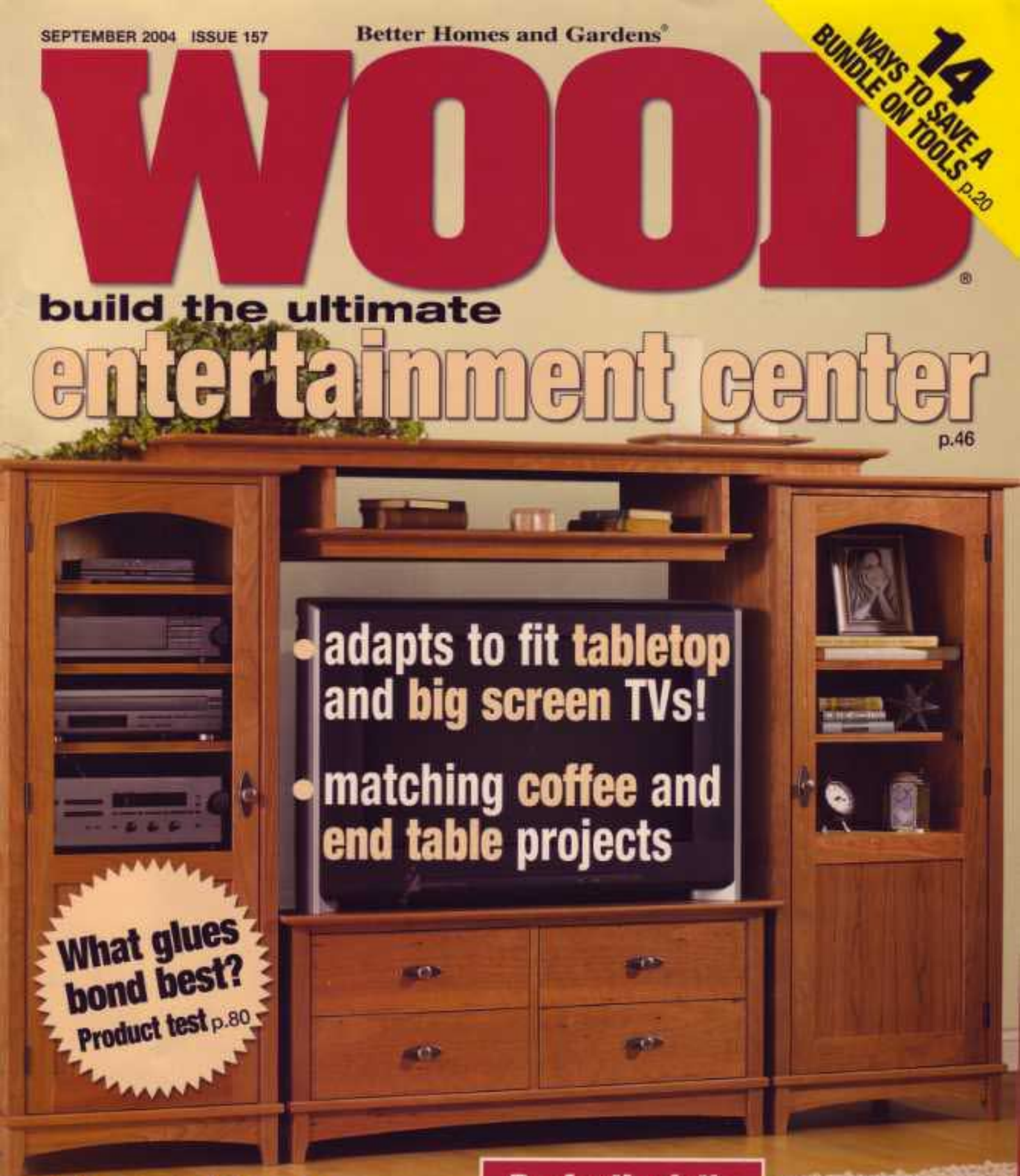
WOOD®

14 WAYS TO SAVE A BUNDLE ON TOOLS p.20

build the ultimate

entertainment center

p.46



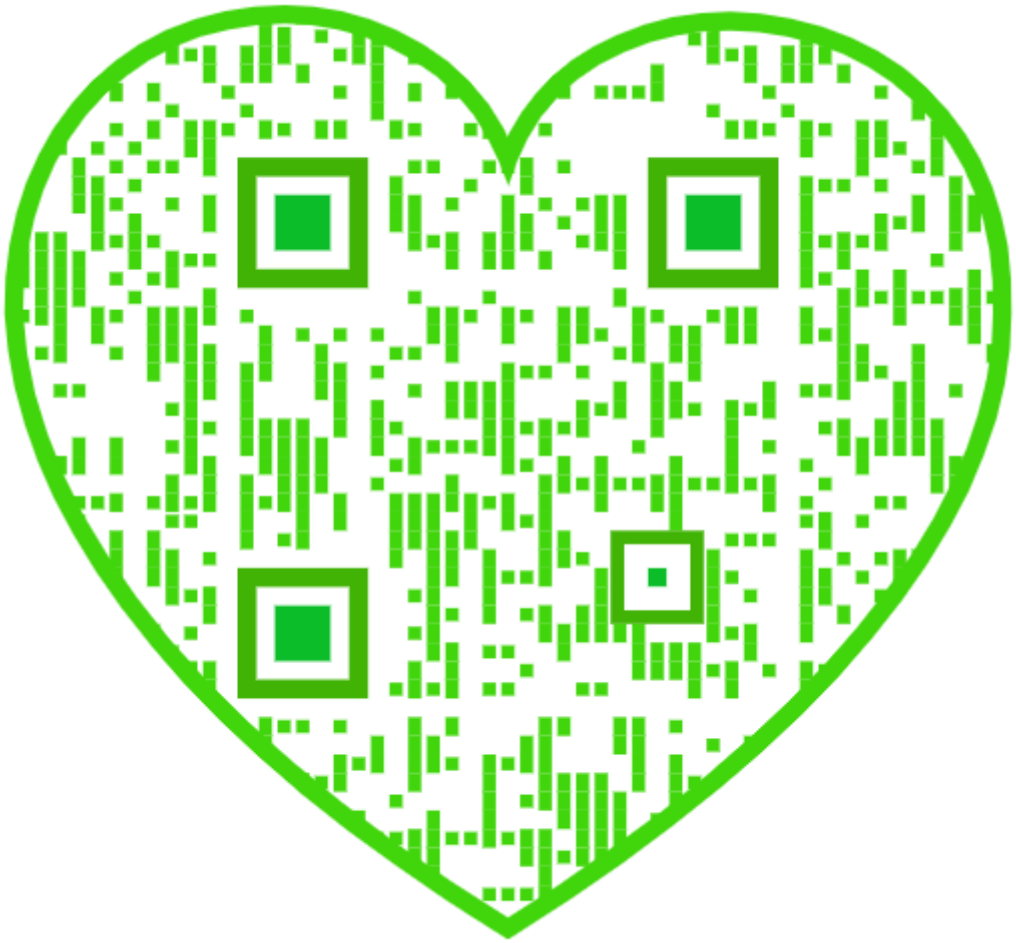
- adapts to fit tabletop and big screen TVs!
- matching coffee and end table projects

What glues bond best? Product test p.80

18 habits of successful woodworkers p.70

Perfectionist's guide to airtight joints p.74

Display until August 31, 2004
U.S.A. $6.99
09
0 92567 14072 5



WOOD®

September 2004, Issue 157

PROJECTS

40 easy-lock feather board
46 entertainment center ensemble
- 48 tower cabinet
- 54 TV stand/coffee table
- 66 end table
- 102 cabinet-spanning bridge
- 104 hanging shelf

86 turned base for floral water globe
88 secret-compartment jewelry box
98 business card case

TECHNIQUES

42 show off grain figure with dye
70 habits of successful woodworkers
Take the quiz and see how many of 18 proven practices you perform in your workshop.
74 guide to airtight joinery
Discover the tools, tips, and tricks that guarantee perfect results, regardless of the joint type.
94 make sense of machining wood
96 workshop wiring Q&A

TOOLS & MATERIALS

20 save big bucks on tools
39 wise buys: machinery casters
80 shop test: woodworking glues
Fifteen common glues compete for your money.
114 rated: five shop-proven products

DEPARTMENTS

8 editor's angle
10 sounding board
14 workshop woods
18 wood words
26 short cuts
30 shop tips
110 ask *WOOD*
124 what's ahead

WOOD MAGAZINE SHOP TESTED APPROVED®

This seal is your assurance that we build every project, verify every fact, and test every reviewed tool in our workshop to guarantee your success and complete satisfaction.

66

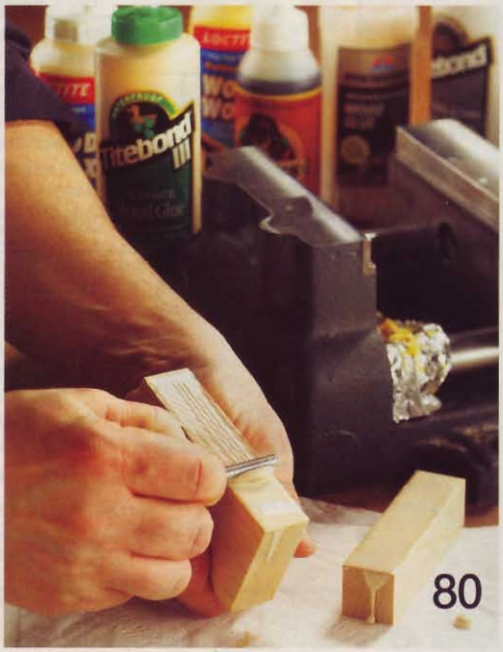
46

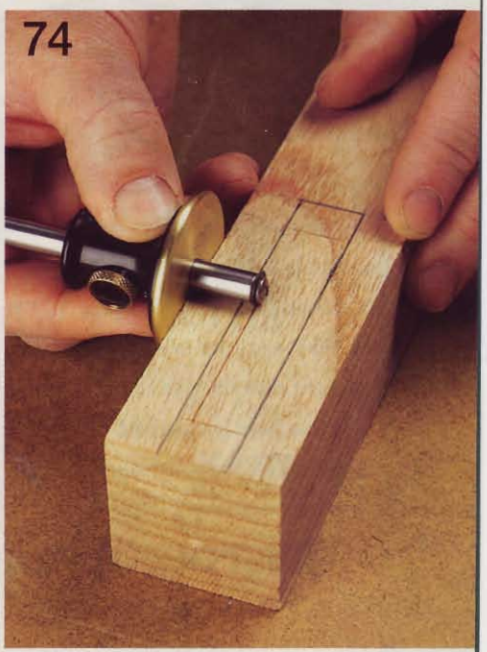
88

54

20

86


80


74

42

Don't buy new.

RENEW!

BRING NEW LIFE to a worn-out tub, an old, faded grill, an avocado refrigerator. All without the hassles and costs of buying something new. Give them a second life with Rust-Oleum® Specialty Paints. Whatever your special paint needs, Rust-Oleum Brands has a specialty finish for you.

Discover Rust-Oleum Specialty Tub & Tile. Its tough, durable Epoxy Acrylic formula looks and feels like your tub's original finish.

Get a new tub look without buying a new tub:

1. **Clean surface** with abrasive household cleaner.
2. **Sand surface** and rinse.
3. **Mix and apply Rust-Oleum Specialty Tub & Tile** using a brush, roller or sprayer.

That's it. And it also works great on tile and sinks. So look for Rust-Oleum Specialty Tub & Tile at home centers, discount and hardware retailers near you.

RUST-OLEUM®

stopping rust is just the start.™

Circle No. 115

© 2003 Rust-Oleum Corporation

Better Homes and Gardens®

WOOD®

September 2004 | Vol. 21, No. 4 | Issue No. 157

Jeff designed and built these maple newel posts and railings in his new house.

EDITOR-IN-CHIEF
BILL KRIER

Executive Editor **JIM HARROLD**
Managing Editor **MARLEN KEMMET**
Senior Design Editor **KEVIN BOYLE**
Tool Editor **DAVE CAMPBELL**
Techniques Editor **DAVID STONE**
Techniques Editor **BOB WILSON**
Projects Editor **OWEN DUVALL**
Projects Editor **JAN SVEC**
Design Editor **JEFF MERTZ**
Master Craftsman **CHUCK HEDLUND**

Art Director **KARL EHLERS**
Associate Art Director **GREG SELLERS**
Assistant Art Director **CHERYL A. CIBULA**

Production/Office Manager **MARGARET CLOSNER**
Administrative Assistant **SHERYL MUNYON**

Photographers
MARTY BALDWIN, SCOTT LITTLE, BLAINE MOATS, JAY WILDE

Illustrators
TIM CAHILL, LORNA JOHNSON, ROXANNE LeMOINE, MIKE MITTERMEIER

Technical Consultants
JOHN CEBUHAR, DEAN FIENE, JEFF HALL

Contributing Craftsman
JIM HEAVEY

Proofreaders
BARBARA KLEIN, JIM SANDERS, MARGARET SMITH

Publisher **MARK HAGEN**

ADVERTISING OFFICE: 333 N. Michigan Ave., Suite 1500, Chicago, IL 60601
Phone: 312/853-2890 Fax: 312/580-7906
Sales and Marketing Assistant **GAYLE CHEJN**
Sales and Marketing Assistant **LISA GREENWOOD**
Account Executive **JACK A. CHRISTIANSEN**
Direct Response Manager **CAROLYN DAKIS**
Direct Response Sales Representative **SANDY ROBINSON**
Account Executive **PATRICK R. TOMLINSON, SR.**
Northeast, Phone: 212/551-7043 Fax: 212/551-7192
Detroit: RPM Associates,
29350 Southfield Road, Suite 31, Southfield, MI 48076
Phone: 248/557-7490 Fax: 248/557-7499
Southeast: Lagomarsino, Dempsey & Dennis, Inc.
2951 Piedmont Rd. NE, Suite 100, Atlanta, GA 30305
Phone: 404/261-5400 Fax: 404/261-5404

Group Marketing Director **CATHY E. SMITH**
Promotion Art Director **SARAH MASSIMO**

Group Publisher **STEPHEN B. LEVINSON**

Associate Business Director **CRAIG FEAR**
Consumer Marketing Director **ROBIN HUTCHINSON**
Consumer Marketing Manager **LESLIE SHAEFFER**
Newsstand Product Manager **LISA TROM**
Advertising Operations Manager **PAT HENDERSHOTT**
Production Manager **STEVE KRIDER**

Vice President/Publishing Director **WILLIAM R. REED**

MEREDITH PUBLISHING GROUP
President **JACK GRIFFIN**
Corporate Solutions **MICHAEL BROWNSTEIN**
Creative Services **ELLEN DELATHOUDER**
Manufacturing **BRUCE HESTON**
Consumer Marketing **KARLA JEFFRIES**
Finance and Administration **MAX RUNCIMAN**

Meredith CORPORATION
WILLIAM T. KERR, Chairman and Chief Executive Officer
STEPHEN M. LACY, President and Chief Operating Officer

In Memoriam — E.T. Meredith III (1933–2003)

Jeff and student Joe Cowles (front) with the clock Joe built in Jeff's shop class.

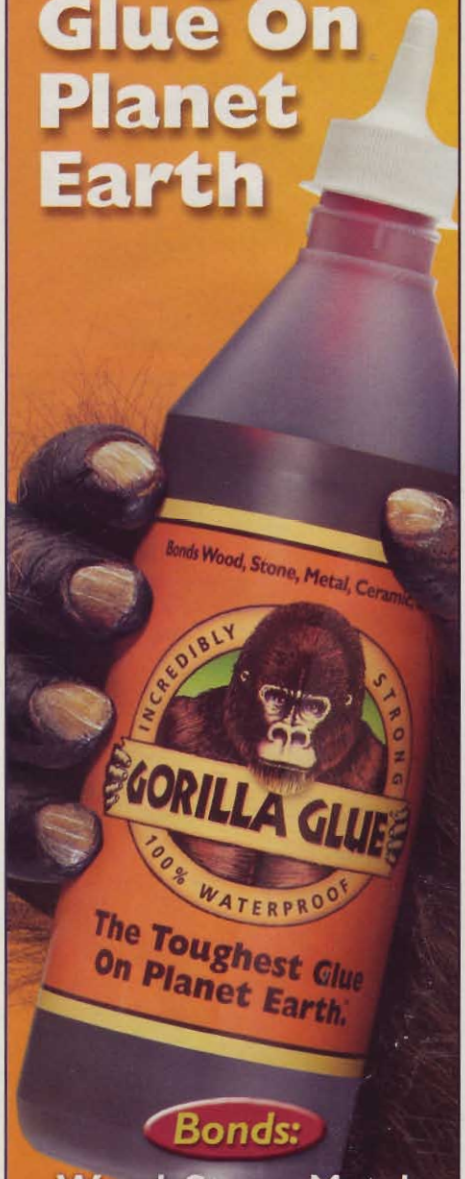
Max takes a seat behind the quarter-sawn white oak panel desk he designed and built for his home office.

©Copyright Meredith Corporation 2004
All rights reserved. Printed in the U.S.A.

MPA

For subscription and editorial inquiries, see "How to Reach Us" on *page 10.*

The Toughest Glue On Planet Earth



Bonds:
Wood, Stone, Metal, Ceramic, & More!

Gorilla Glue is the versatile, interior/exterior adhesive ideal for most household fixes and building projects: furniture repair, crafts, woodworking, and general repairs around the house. **Bonds wood, stone, metal, ceramic & more! Incredibly strong and 100% waterproof.**

REQUEST YOUR FREE INFORMATION KIT!
www.gorillaglue.com
1-800-966-3458

Circle No. 50

Numbers that move me

As woodworkers we're used to dealing with numbers: fractions, board feet, threads-per-inch, you name it. So ponder, if you will, these numbers: 20, 550,000, and 8,539. Those figures have really inspired me lately. And you have everything to do with it.

Charter subscribers Linda and Marion Ivey "were in the neighborhood" recently and spent some time with me in the *WOOD* magazine shop.

First, let's deal with the number 20. It was exactly 20 years ago when the debut issue of *WOOD*® magazine arrived in mailboxes and on newsstands. It was an instant hit with readers, and today, with a circulation of 550,000, *WOOD* is by far the most widely read woodworking magazine on the planet. For that I sincerely thank each of you, our loyal readers.

And when I say "loyal," I mean it. Many of you have renewed your subscription nonstop for the past 5, 10, and even 15 years! Knowing that, I was curious as to how many of you have been with us for the full 20 years. Well, I was stunned to find that 8,539 of you have subscribed continuously since 1984. Wow!

Putting faces with those numbers

Recently, one of those 8,539 charter subscribers stopped by our shop to pay a visit and get a look around the place. Marion and Linda Ivey, the handsome couple with me in the photo, hail from Bogart, Georgia, where they operate Ivey Interiors. Marion, the woodworker, handles the construction part of their home-remodeling business, and Linda does the interior decorating.

Now here's the part about the Iveys that surprised me. When I asked these Georgians what brought them to our Iowa offices, Marion replied "We were in the neighborhood, visiting relatives, and thought we would stop by."

"So," I asked, "your relatives live here, in Des Moines?"

"No," Marion answered, "they live in South Bend, Indiana."

Now, if you're familiar with the Midwest, you know there's a lot of real estate between South Bend and Des Moines. More evidence that woodworkers pursue their hobbies with more passion than anybody.

A special project to celebrate that number 20

We wanted to do something special in this issue to recognize our 20th anniversary, so we've gone all out to design and build the most versatile entertainment center to ever grace these pages. Actually, it's more than a *center*—it's a *suite* designed to work with nearly any of the infinite number of TV sizes available today. The base under the TV can be used as a coffee table, and we've included matching end tables. Team up these pieces with your most comfy couch, and you're ready for show time!

Here's to many more years of serving you

WOOD magazine has undergone many changes in the past two decades, but our central mission—to inspire, inform, and entertain home woodworkers via a magazine of unmatched quality—has stayed the same since issue No. 1. We plan to be here 20 years from now, bigger and better than ever, and we hope you'll continue to enjoy the ride too.

Bill Krier

sounding board

Our bulletin board for letters, comments, and timely updates

Three ways to create crown-molding miters

In the Crown-Molding Shelf project in the December 2003 issue (no. 153 page 108), the instructions call for mitering the ends of the crown molding, but don't say how. Wouldn't these be compound angles?

Bill Beaton, Gibons, B.C.

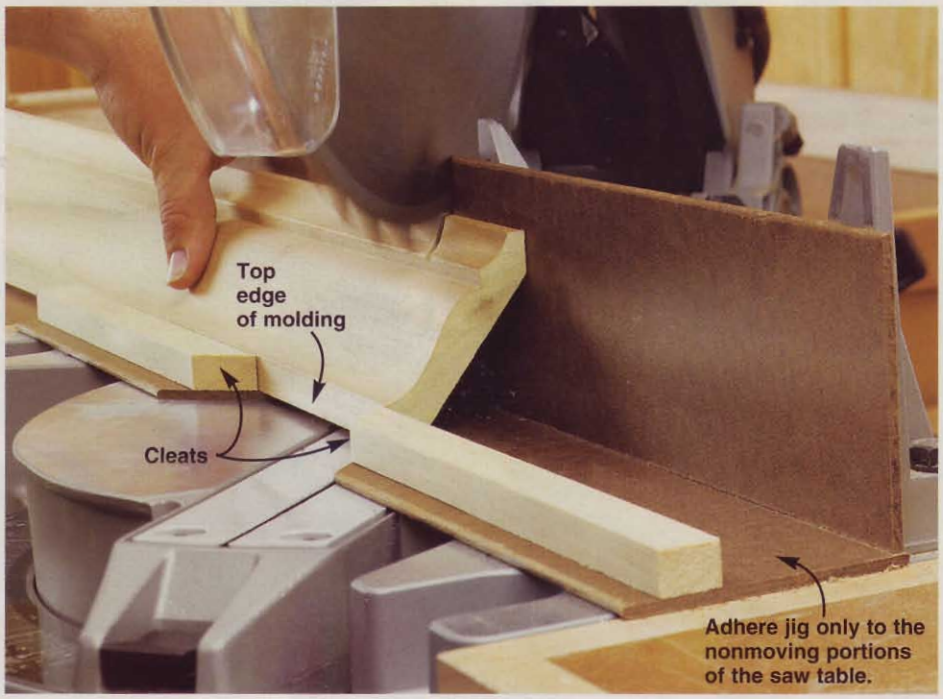
Yes, mitering crown molding does require cutting compound angles, but you don't need a compound mitersaw to do it.

If you have a standard mitersaw, cut the molding "upside down," as shown below. *The jig makes this task easier by preventing the molding from slipping as you cut. It consists of a couple of hardboard scraps and solid wood cleats adhered to the saw with double-faced tape. Using this setup you can cut your molding to length, relying on the saw's built-in 45° and 90° stops.*

If you have a compound mitersaw, lay the molding flat on the table. Set the miter angle at 31.62°—a positive stop on many compound mitersaws—and the bevel angle at 33.86° (34° is close enough).

You can accomplish these cuts at the tablesaw, too. But you'll need to make test cuts in scrap to get the angles just right.

The WOOD® *magazine staff*



Wall-hung grinder station

Your Idea Shop 5 articles arrived just in time for me to incorporate the concepts into my new 20×30' shop. I built the wall-cleat system (no. 152, page 86) to hold cabinets, perforated tool panels, and clamp racks.

Then, I devised the grinder station, *below*, that hangs from the cleats, too. It's made of a ¾×18×36" MDF back panel with a ⅜×¾" dado cut 6" from one end. Into that I inserted a 12×18" shelf supported by two triangular gussets. I glued and screwed it together, then added the hanging cleat at the top and the spacer at the bottom.

John Brown, Duncan, Okla.

Continued on page 12

HOW TO REACH US

- **Editorial questions and feedback:** E-mail woodmail@woodmagazine.com; call 800/374-9663 and press option 2; or write to WOOD magazine, 1716 Locust St., GA-310, Des Moines, IA 50309-3023.
- **Subscription assistance:** To notify us of an address change, or to get help with your subscription, go to woodmagazine.com/service; call 800/374-9663 and press option 1; or write to: WOOD magazine, P.O. Box 37439, Boone, IA 50037-0439. Please enclose your address label from a recent magazine issue.
- **To find past articles:** Go to our continuously updated online index at woodmagazine.com/index.
- **To order past issues and articles:** You can order past issues of *WOOD* magazine and our newsstand special issues at woodstore.woodmall.com, or by calling 800/346-9663. Be aware that many early issues are sold out. For reprints, send $5 per article (no phone orders), including the article name and issue number, to: WOOD Article Reprint Service, P.O. Box 349, Kalona, IA 52247; make check or money order payable to *WOOD* magazine.

Updates to previously published projects: For a complete listing of known changes in dimensions and buying-guide sources from issue 1 through today, go to woodmagazine.com/editorial.

A ton of tables

As a shop teacher, I knew your Occasional Table (no. 150, page 52) would make a great project for students in my 8th-grade shop class. We made a few changes, building ours from pine to reduce costs, and downsizing the dimensions so the tables would fit into the students' storage cubbies.

As you can see in the photo, we built over 40 tables, and I think they came out great. I'm really proud of the kids. Thanks for the inspiration. I look forward to more great project plans in future issues.

John Reed, Instructor, McFarland Middle School, McFarland, Calif.

To ensure safe cutting, pull rather than push a radial-arm saw

I disagree with your statement in the March 2004 issue (no. 154, page 75) that you should pull rather than push a radial-arm saw when cutting. If you push your radial-arm saw through the workpiece, you control the feed speed and there's no danger of the saw lurching toward you.

Mike LaFave, Westland, Mich.

We received a few letters like yours, Mike, so we talked to manufacturers. They recommend against pushing your radial-arm saw (RAS) for the following reasons:

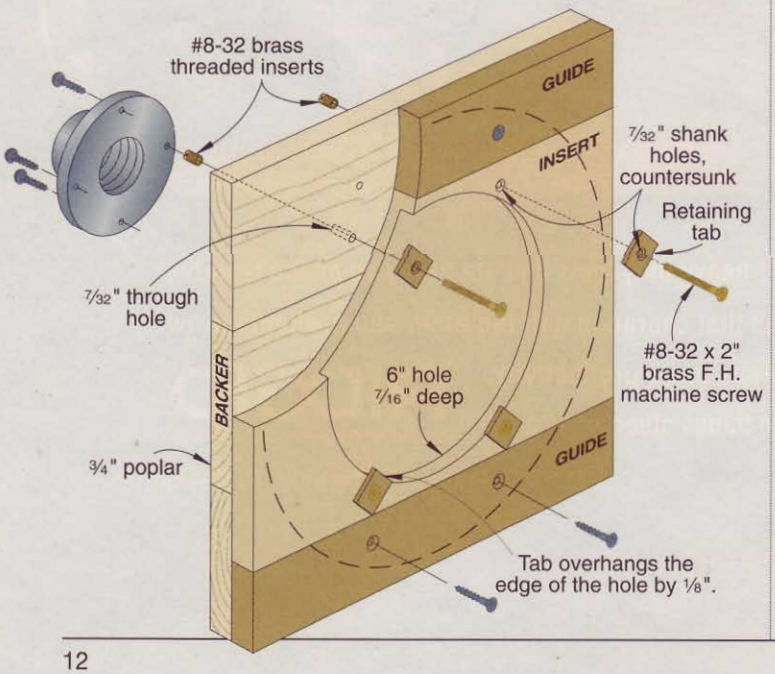
- *The upward cutting action can lift the workpiece, and an RAS doesn't have a hold-down, like a sliding compound miter-saw (SCMS), to prevent this.*
- *An SCMS blade guard covers the entire blade. An RAS blade guard does not.*
- *Placing the board behind the blade on an RAS can be an awkward and dangerous procedure because the saw head moves freely on the arm and the blade's back edge remains exposed.*

The WOOD® *magazine staff*

Reader inserts his own ideas in the trivet-turning faceplate

I enjoyed making the "Trivet Pursuit" trivets (no. 154, page 70). But I was concerned I might lose the small nuts and washers that secure the screws used to hold the trivet blank to the auxiliary faceplate. I modified the faceplate by replacing the nuts and washers with #8-32 threaded inserts. I made the backer from poplar because I thought the inserts might not hold in MDF.

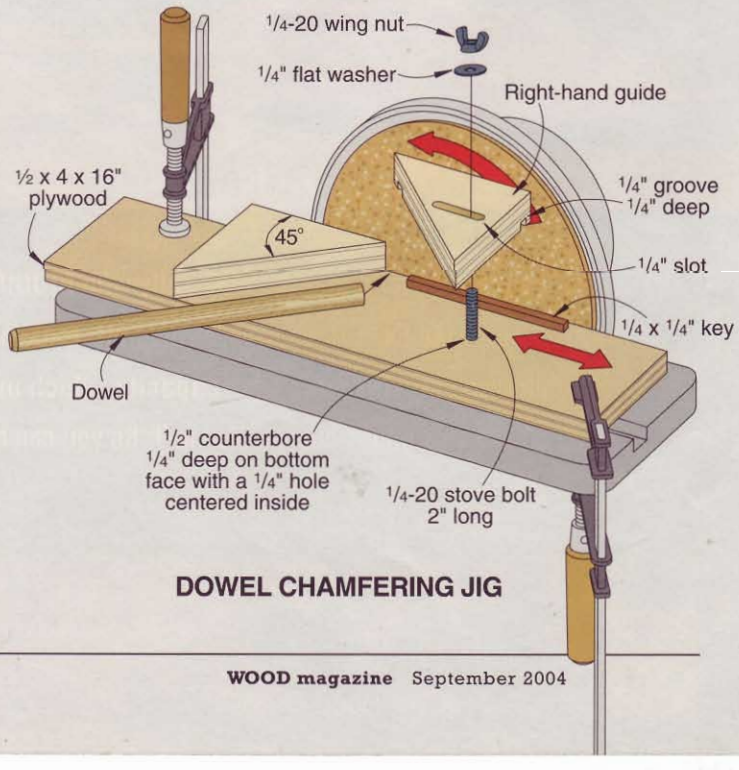
Dennis Saatdjian, Old Bridge, N.J.



Adding easy adjustability to the dowel chamfering jig

I made the dowel chamfering jig from your March 2004 issue (no. 154, page 12), but modified mine as shown by putting the movable guide on a runner and adding a wing nut and bolt to lock it down. Now I can easily adjust the jig to create chamfers of any size. Thanks for the great plan.

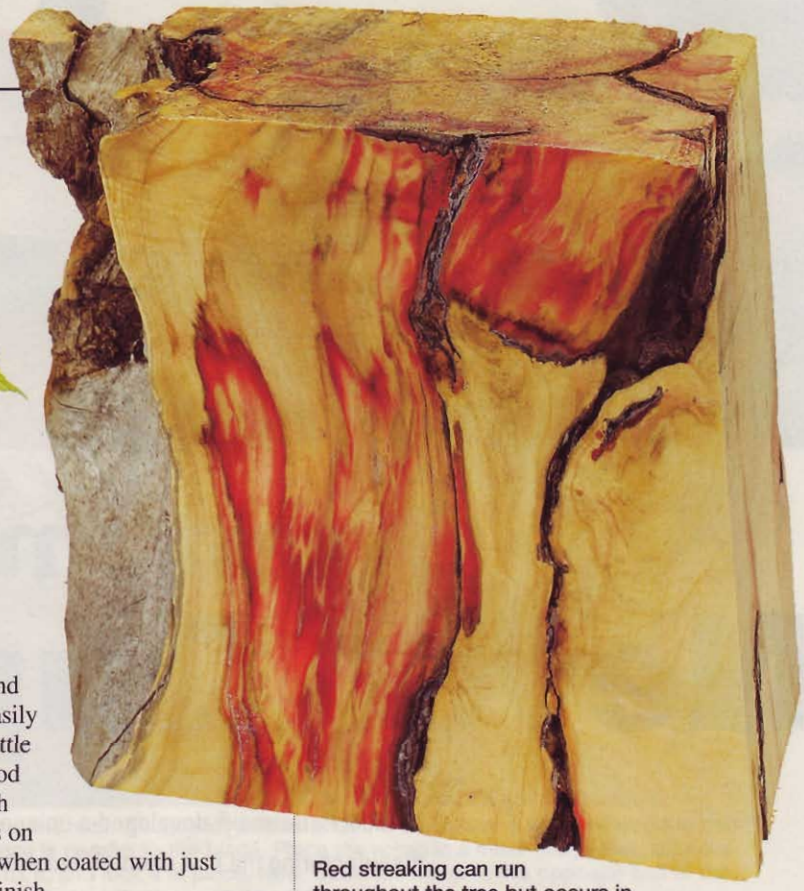
Walter Fick, West Chester, Ohio


1/4-20 wing nut
1/4" flat washer
Right-hand guide
1/2 x 4 x 16" plywood
45°
1/4" groove 1/4" deep
1/4" slot
1/4 x 1/4" key
Dowel
1/2" counterbore 1/4" deep on bottom face with a 1/4" hole centered inside
1/4-20 stove bolt 2" long

DOWEL CHAMFERING JIG

boxelder

Maple's lowly but sometimes colorful cousin

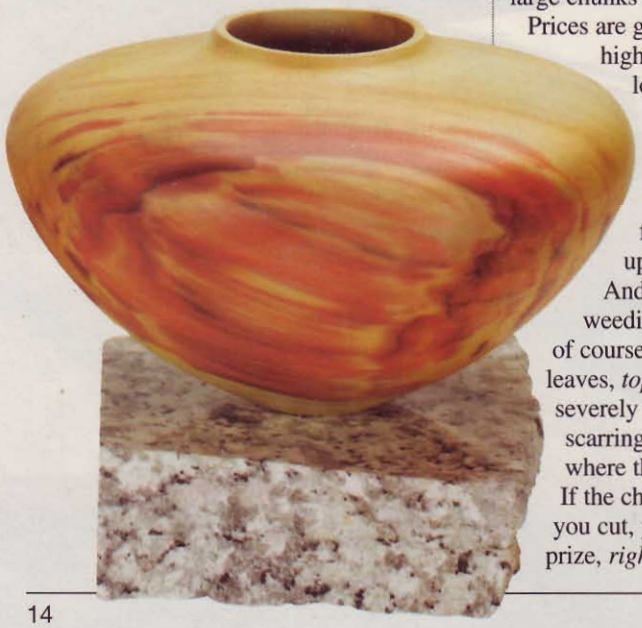


Red streaking can run throughout the tree but occurs in greatest abundance in the lower trunk. Bark inclusions are common near the base of the tree and may limit blank size.

Scruffy looking, short-lived, and home to an annoying little bug that bears its name, the boxelder (*Acer negundo*) wouldn't readily appear to be a tree that woodworkers might prize. You can find it throughout the East and Great Plains, *right*, where it grows rapidly to heights of 30' to 50'. Those that are harvested usually end up as firewood, crates, or paper pulp.

This comes as no surprise, as the tree produces lightweight wood, at just 31 pounds per cubic foot (pcf)—as opposed to 43 pcf for hard maple—with typically unremarkable grain and a creamy white hue. Adding insult to injury, boxelder trees easily become damaged, which invites fungal infestation.

This fungus, though, transforms the lowly wood by creating streaks of vivid red. Woodturners, especially, prize this stock and use it to produce beautiful bowls and vessels, such as the one *below*.



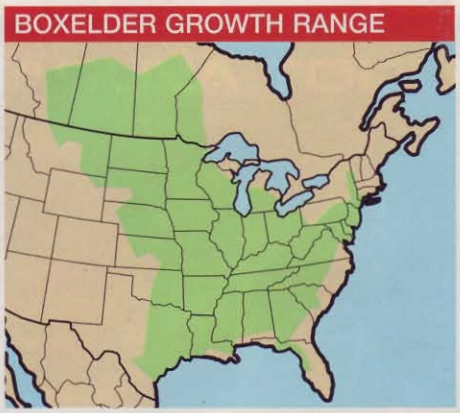
Turners also find boxelder to be easily workable, with little tear-out. The wood sands to a smooth surface and takes on a lustrous sheen when coated with just about any clear finish.

Boxelder's red will fade over time to a brownish hue. To preserve the color as long as possible, keep the wood out of direct sunlight, and use a finish with ultraviolet (UV) inhibitors.

Finding the wood

Locating boxelder can be challenging. You'll rarely encounter it milled into boards, though you may be getting it mixed in when you buy soft maple. By searching out retailers that specialize in turning blanks, you can locate colorful stock ranging in size from small pen blanks to large chunks suitable for bowls and vessels. Prices are generally reasonable; but large, highly figured blanks may fetch lofty sums.

If you have a chainsaw and a sense of adventure, you may be able to get all of the colorful boxelder you want for free. The tree often springs up, weedlike, along field edges. And farmers may welcome you weeding them out (with permission, of course). Just look for the distinctive leaves, *top*, and a trunk that leans severely or shows signs of twisting, scarring, or other damage—that's where the reddest streaking occurs. If the chainsaw begins spewing red as you cut, you may have found a worthy prize, *right*.



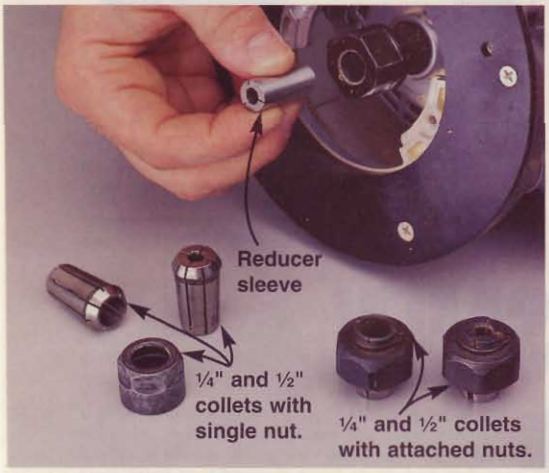
Cutting into a boxelder may reveal just creamy wood suitable to burn or amazing red color that begs you to turn.

wood words

A quick guide to must-know terms used throughout *WOOD*® magazine

Collet: A metal slotted sleeve that holds a router bit in place in the router shaft. Secured by a nut, the collet clamps around the shank of the bit.

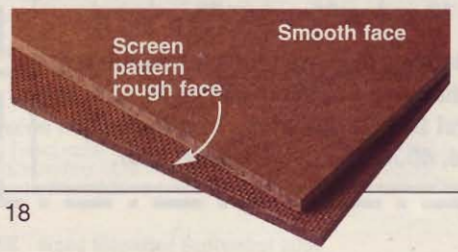
Many routers come with both ¼" and ½" collets to accommodate available bits, but some inexpensive models are equipped with only a ¼" collet. Some include a ½" collet and a reducer sleeve, as shown, *below*. Collet styles vary: they typically are not interchangeable between router brands.



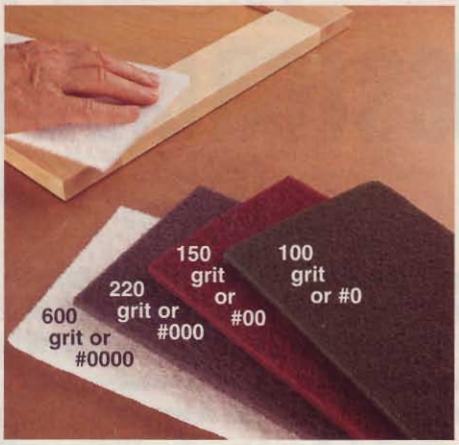
Dead-blow hammer: A plastic-bodied hammer with a hollow head that's partially filled with steel shot. When struck against an object, the shot shifts quickly to that end of the head. This transfer of mass prevents the head from bouncing and delivers a solid blow without marring workpieces. Dead-blow hammers are ideal for assembling and disassembling projects.

Hardboard: A combination of ground wood pulp and resins pressed into 4×8' sheets, typically ⅛" or ¼" thick. Hardboard comes in three grades: service, standard, and service-tempered (the best choice for shop use), with one smooth face or two, as shown, *below*. The material often goes by "Masonite," the brand name used by one manufacturer.

Another version of this material, known as perforated hardboard (or by the brand name Peg-Board), consists of a ¼"-thick sheet with ⅛"- or ¼"-diameter holes drilled at regular intervals. The holes receive hooks that are often used for tool storage.



Synthetic steel wool: These flexible abrasive pads are made from thin plastic fibers impregnated with abrasive particles. The fibers are compressed together in a "non-woven" (random) pattern. These pads prove exceptionally useful for sanding woodworking projects, especially between coats of finish. The pads are often referred to as Scotch-Brite pads (the brand name of one such product).You can purchase them from woodworking suppliers in several grits, as shown, *below*, with their corresponding sandpaper grit or steel wool number.



V-block: A piece of wood with a V-shape groove cut into one face. This device, which is most often shop made, securely holds dowels or other rounded objects in position while drilling.

Hardwood: Wood derived from broadleaf trees—oak, walnut, ash, and cherry, for example. In temperate regions, these trees are deciduous, dropping their leaves annually. Called angiosperms, the trees produce seeds in the form of fruits or nuts.

Not all hardwoods are hard and heavy. Balsa, for example, is classified as a hardwood although it contains light, soft wood.

Softwood: Wood derived from needle-leaf trees—spruce, pine, fir, and cedar, for example. Commonly known as conifers, these trees produce seeds encased in cones, and are also called gymnosperms. Softwood trees are almost always evergreen, retaining their needles year-round.

Some softwoods, such as spruce, are soft, but others, such as ponderosa pine, are hard and remarkably strong.

Find more woodworking terms at **woodmagazine.com/woodwords**

BIG Bucks

$ave on Tool$

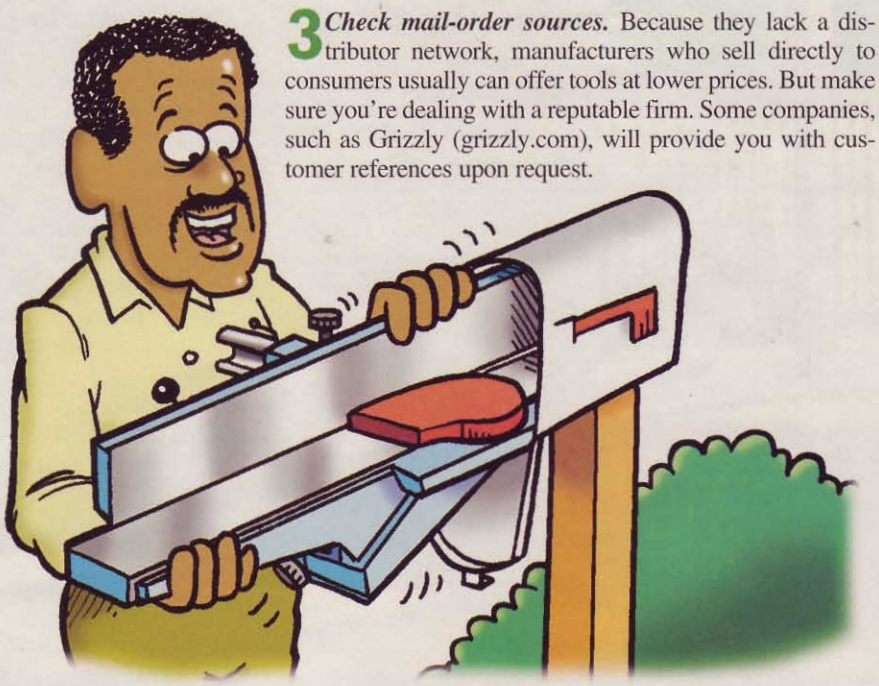
You don't need to be rich to outfit a smart shop—you just need to *shop smart.* Here are 14 money-saving strategies to help you get the most bang (and whirr, and hummm, and buzzz) for your tool-buying buck.

Recognize good deals

1 ***Do your research before you buy.*** Watch Sunday newspaper ads, study tool catalogs, and make mental notes as you peruse tool stores and home centers so you can identify a real bargain when it comes along. Don't be fooled by comparisons to "list prices," which are sometimes as much as twice the normal selling price. And have patience: Today's gotta-have gadget may be a why-bother tool next year. You also may find that the price of a newly introduced tool drops after the newness has worn off or when the manufacturer replaces it with an updated model.

2 ***Opt for multifunction tools or bonus accessories.*** A drill press that comes with a mortising attachment, for example, will save you from buying a dedicated mortiser, at least for a while; likewise, a tablesaw that comes with a high-quality blade. A hammer drill can be used for ordinary drilling, too, and doesn't cost much more than a non-hammer drill. Some wise-buy tools do more than one job equally well. For instance, Shop Fox (shopfox.biz) sells a benchtop drill press that doubles as an oscillating spindle sander; Ridgid's (ridgid.com) edge-belt/spindle sander works equally well on both flat and curved edges.

Continued on page 22



3 ***Check mail-order sources.*** Because they lack a distributor network, manufacturers who sell directly to consumers usually can offer tools at lower prices. But make sure you're dealing with a reputable firm. Some companies, such as Grizzly (grizzly.com), will provide you with customer references upon request.

5 ***Replace the tool, not just the battery.*** The first thing to fail on most cordless tools is the battery, but a pair of new batteries can set you back almost as much as a new tool. And that new model may have more features or higher voltage, so it's like a low-cost upgrade.

That strategy doesn't apply to cordless kits with several tools sharing one or two battery packs; but you can economize here as well. Before you buy such a kit, consider the voltage and style that fits all the cordless tools you may eventually want to buy.

4 ***Buy the best you can afford, and the cheapest you can find.*** You'll only cry once when you buy a top-grade tool. On the other hand, a cheaply built tool may not cut or hold its accuracy well, and your joy over the initial savings may give way to tears of frustration each time you use it.

But be realistic—you don't always need to buy the best. If you think a pneumatic brad nailer will come in handy, purchase a $20 model and use it up. Even if it lasts for only a handful of projects, you can buy five inexpensive brad nailers before you outspend a $100 nailer.

Need you buy new?

6 ***Buy reconditioned tools with a full warranty.*** Manufacturers can't sell returned tools as new, even if they're unused but lacking their original packaging. So, if necessary, they replace any bad or broken parts with new ones, repackage the tool, and then resell it as "reconditioned." You risk little because manufacturers typically honor the full factory warranty on these tools, and unlike new-in-the-box tools, recons get a complete and thorough test at the service center before they're repackaged and resold.

7 ***Find a demo.*** An exhibitor at a woodworking show will sometimes sell a stationary tool off the show floor, rather than pay to ship it back. Ask if you can take it off his or her hands for a discounted price when the show is over. You may get a good deal on a tool that's already assembled, and save shipping costs. Also, watch for special scratch-and-dent and tent sales from some manufacturers. In many cases, the damage is cosmetic and you can pick up a perfectly functioning tool at a deep discount.

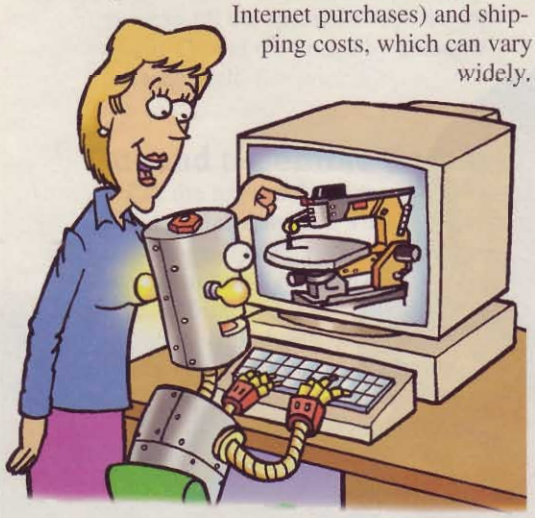
8 ***Buy from a private owner.*** Your local newspaper classified advertising section is a good source for used tools. Besides scanning the "Tools" classification, pore over the garage sales and auction notices. Often, sellers don't know (or don't care) what they have and underestimate its value. Beware of buying used power tools from pawn shops, though: Sometimes these tools are overpriced for their quality and condition. And don't overlook more high-tech search methods of finding used tools—online classifieds, such as those at *WOOD Online®* (woodmagazine.com/classifieds), and virtual auctions, such as eBay (ebay.com).

Continued on page 24

Chop the posted price

9 ***Leverage with the Internet.*** Let your computer do the shopping by using Internet "shopping bots"—online programs that seek out products and prices in a flash. Consumer-oriented bots, such as My Simon (mysimon.com), search for everything under the sun, including tools. But one of our favorite tool-comparison Web sites is Toolseeker (toolseeker.com) because you choose which specific models to compare, and then check their specs and prices from several online retailers. Toolseeker even offers virtual coupons for discounts.

Armed with your best price from the Net, see if your local tool dealer will honor that price or meet you somewhere in between. When dealing, remember to figure the impact of sales tax (typically not paid on Internet purchases) and shipping costs, which can vary widely.



10 ***Pit the "big-box" stores against each other.*** Most major home centers offer price guarantees: If you find a tool advertised somewhere else for less, they'll sell it to you for 10 percent less than the competitor's price. Beware, though, that model numbers must match exactly, and some retailers sell nearly identical tools with slightly different numbers to avoid paying out on that guarantee.

11 ***Sign on the line and save.*** Home centers sometimes offer a 10 percent discount on purchases made with a new credit card. Watch for a sale on a major tool, sign up for the card, and take another chunk off the sale price. Make sure you pay the balance on your card as soon as possible to avoid eating up your big savings in finance charges.

12 ***Watch your e-mailbox for bargains.*** Many tool catalogs and manufacturers offer exclusive prices to people who register on their Web site. For example, MLCS (mlcswoodworking.com) recently offered $15 off the price of a router-table fence with a special link in its e-mail newsletter. Without the link, you would have paid the full $95 retail price.

The art of the deal: A case study

To see how little we could pay for a tool, we searched high and low for the best price on a Makita 6337DWDE 14.4-volt cordless drill. At a local tool dealer (a Makita-authorized service center), we found the drill for $189 plus tax. The dealer declined to match the lowest price we found in our area: $177 at two different big-box home centers. One of those home centers was running a "use our credit card and save 10 percent" promotion, reducing our price to $159.30 plus tax.

Next, we scoured the Internet using several shopping "bots," and found prices ranging from $168 in the "Classifieds" section of Pricing Central (pricingcentral.com); to $175 at both Toolseeker and Amazon.com; to $188 using Froogle (froogle.com). The Froogle search, however, also led us to Tool King (toolking.com), where we found a reconditioned 6337DWDE with a full one-year warranty for $136. (All Web prices include shipping and handling, where applicable.)

Written by **Dave Campbell** Illustrations: **Buck Jones**

Save by the season

13 ***Take advantage of seasonal discounts.*** After the two big tool-giving holidays of the year—Christmas and Father's Day—retailers and home centers often offer deep discounts to clear their shelves of overstocked product. Some manufacturers even put together special cordless kits just for these holidays, never to offer them again. Grab these bargains while you can.

14 ***Let someone else pick up the tab.*** Some Web retailers, such as Tool Crib (amazon.com/toolcrib), now allow you to register your "wish list," much like a bride registers for stemware. So for the next birthday, Father's Day, or Christmas, point your loved ones to your Web-based wish list; that way, you and the giver are assured of a present that will be appreciated.

short cuts

News and notes from the woodworking world

This titanium hammer, with its interchangeable smooth or milled face, cost a bundle, but may be worth it for the professional framer.

A $200 hammer? Yep

While paging through a tool catalog, we found a $200 claw framing hammer and thought, "What hammer merits that kind of price tag?" Curious, we tested one in the *WOOD* shop and at a construction site.

The tool, a model TiBone 15MS, is a 15-ounce, milled-face framing hammer made by Stiletto Tools in Atwater, California. Company president and owner Mark Martinez praised the hammer when asked. "Because it's made of titanium, it's ten times more shock-absorbant than steel," he said. "And it weighs 40 percent less, leading to less arm fatique. The openings in the head and neck reduce shock, as does the rubberlike handle."

In the shop, we tested it against 22-ounce all-steel and fiberglass-handled hammers that cost $25 each, driving 16-penny nails in 2×2 and 2×4 stock. "Because the head is larger and lighter, you need to concentrate more on control during the swing," said Master Craftsman Chuck Hedlund. Chuck also didn't care for the ringing sound created by the titanium or the openings in the head. "I sometimes use the side of a hammer head to drive nails in tight places."

House framer Jacob Tessmer praised the tool, saying "I prefer it over my heavier Estwing framing hammer." He cited advantages in heft and shock absorption. He also liked the magnetic nail-holder for starting nails, saying he could nail faster with the Tibone. "I can set the spike with the first smack, drive it home with the next," he said.

So is the TiBone 15MS worth $200? For the long-term professional framer, we'd have to say "yes," particularly if there's concern about joint pain. To learn more about Stiletto's hammers, call 800/987-1849, or visit store.stilettotools.

Zink the zebra rides again

The sign in the photo *below* reads "zebra," and yet the rocking horse in the foreground doesn't match up—instead of stripes it has dots. So why call it a zebra? Therein lies the story.

Back in 1993, nine-year-old Kelly Weil spent the year battling bone cancer. Prior to that she enjoyed swimming, horseback riding, and visits to the zoo. Once she began treatment, which included surgery and chemotherapy, hair loss, and, finally, confinement to a wheelchair, her appearance changed for the worse. This led to hurtful teasing by schoolmates.

After she passed away later that year, Kelly's parents found a story she wrote. It was about Zink, a zebra that was born with spots instead of stripes, which caused other zebras to shun it. Realizing the pain his daughter must have suffered, Kelly's father, Les Weil, began the Zink the Zebra Foundation. It's mission: to promote the education of children in understanding, respect, compassion, and acceptance.

At that point, a Girl Scout leader in southwest Texas turned to woodworker John Vandenbosch, a member of the Woodworkers Club of El Paso, to build a spotted rocking zebra that could serve as a teaching tool, emphasizing that it's OK to be different. John consented.

Over the last decade, thanks to Weil's persistance, the Zink the Zebra teaching program spread nationwide, being taught in 50 of 320 Girl Scout councils, as well as some public schools. Truly, Zink rides again.

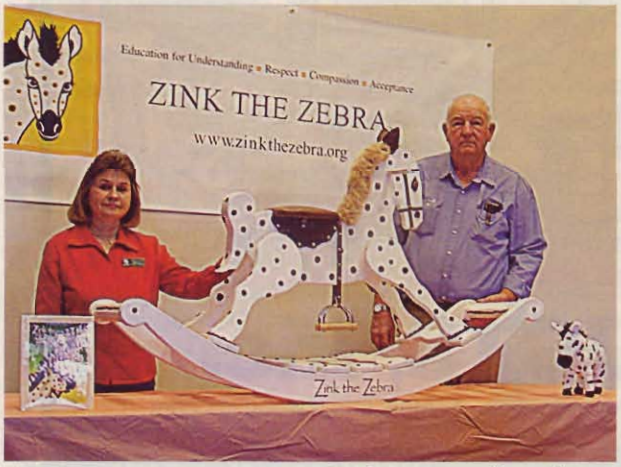


Photo: Robert Bonner

Grace Rocha of the Rio Grande Girl Scout council, receives a zebra rocking horse from woodworker John Vandenbosch.

When can kids start woodworking? Try age 3

In the words of the spokespeople at Hasbro, they have taken their Play-Doh product line "to a whole new place," and that's good news for budding tool junkies and woodworkers. Hasbro recently expanded its playsets to include Play-Doh "Buzzing Buzz Saw" ($12.99), "Power Drill Kit" ($7.99), and "Hand Tools" ($3.99).

Thanks to Hasbro's innovative playsets, now the very youngest woodworkers can log in shop time making Play-Doh structures with power and hand tools.

The benchtop bandsaw contains a thick wire that buzzes and vibrates, allowing kids to cut clay boards and molding made with their Play-Doh extruder and template. The reversible drill drives screws, and the hammer and saw—well, we know what they do. The Play-Doh that comes with each playset also offers something brand new—it's cedar-scented. Find all three playsets at your local toy dealer.

Continued on page 28

Deborah Norville's adventure in woodworking

Photo: courtesy of King World

A busy mother of three in addition to being the host of TV's syndicated *Inside Edition* and most recently *Deborah Norville Tonight*, Deborah doesn't fit the profile of your typical home woodworker. She's glamorous, has authored three books, co-hosted the *Today* show, and won a pair of Emmies. Still, when the need arises, she's not adverse to using a power tool.

This past year Deborah, after shopping around for a headboard and not finding any to her liking, turned her frustration into positive energy. The fledgling woodworker based the dimensions and design on a king-size headboard in her country home. Says Deborah, "I used an electric drill and also a jigsaw to cut the curves in the plywood, and cut the pine and cedar posts in my Manhattan apartment. It was more of an upholstery job than anything."

Her tight schedule and apartment restrictions forced her to pick away at the project in 45-minute chunks every day for several weeks. "My husband thinks I'm nuts!" Deborah says. "He totally did not understand my 'do-it-yourself' leanings until I explained it this way: We live in New York. Everyone has a shrink. Me, I have my sewing machine! [And a few portable power tools, we'd like to add.] Now he finally understands."

New fastener standards for pressure-treated wood

On January 1, 2004, lumber manufacturers stopped making pressure-treated lumber treated with Chromated Copper Arsenate (CCA) for environmental reasons. Today, they treat lumber with a new generation of chemicals—the most common being Amine Copper Quaternary (ACQ).

While safer, ACQ-treated wood has fastener corrosion rates up to three times greater than CCA-treated wood. As a result, manufacturers now recommend using hot-dipped galvanized or stainless-steel screws and nails. Manufacturers caution against aluminum.

Use hot-dipped galvanized and stainless-steel screws and nails with today's pressure-treated lumber.

Test your workshop smarts

Looking for a challenge? Take on the questions *below*. For answers, see the Short Cuts in the next issue of *WOOD*® magazine. If you can't wait, go now to woodmagazine.com/shortcuts.

■ **True or false: water rings found on furniture surfaces are in the layer of furniture polish or wax above the finish.**

■ **Can you name the bygone woodworking tool pictured here and explain its use?**

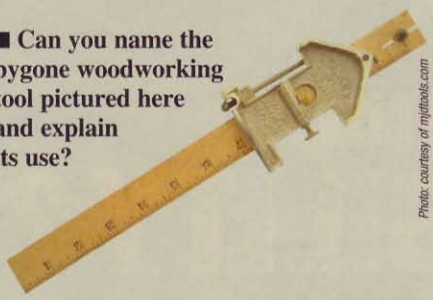


Photo: courtesy of mjdtools.com

■ **What's the best way to rid mold from your lumber stack?**

Answers to the questions in issue 156

■ **Name the exotic hardwood that for centuries has been the preferred species of violin bow makers.**

Pernambuco. Bow makers prize the wood for its density, weight, strength, stiffness, and rich orange to redish-brown color.

A well-crafted pernambuco bow measuring 32" long can cost as much as $10,000.

■ **What clear woodworking finish among oil or film-forming products holds up best in direct sunlight?**

WOOD magazine finish consultant Jim Kull says no perfect defense exists for direct sunlight's impact on wood. Nor will a clear finish prevent wood from darkening from exposure or stop a stain from fading. However, you can minimize sunlight's affect on projects.

Urethane and marine spar varnishes (above) provide the best protection for outdoor projects; use paste wax to protect exposed indoor funiture.

For a clear finish on outdoor projects, Jim says to use a urethane varnish with ultraviolet (UV) protection. The best film-forming finishes are marine varnishes. (Call West Marine at 800/262-8464, or go to westmarine.com.) An excellent alternative is to apply an exterior oil finish made for decks or fences. For indoor projects, apply a paste wax.

■ **For what major workshop tool can we thank the Shakers?**

Shaker legend has it that around 1810, Tabitha Babbitt from the Harvard, Massachusetts, Shaker village was sitting at her spinning wheel when she looked out the window and saw the brethern cutting wood with a straight saw. Then it occurred to her: Why not saw wood with a round blade, turning it much like a spinning wheel?

Some historians point to an earlier Shaker origin of the circular blade, attributing Benjamin Bruce of the Mt. Lebanon village in New York as the inventor, and the physical proof *below* seems to support it. Still others say the circular saw blade dates to 1645 in the Netherlands, and was introduced in England in 1781.

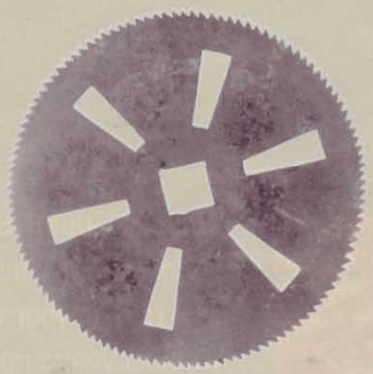


Photo: Courtesy, New York State Museum, Albany, NY

The Shaker most often credited as the inventor of the circular saw blade in America is Benjamin Bruce of Mt. Lebonon, New York. His saw blade (above) was made in 1792.

shop tips

Helping you work faster, smarter, and safer

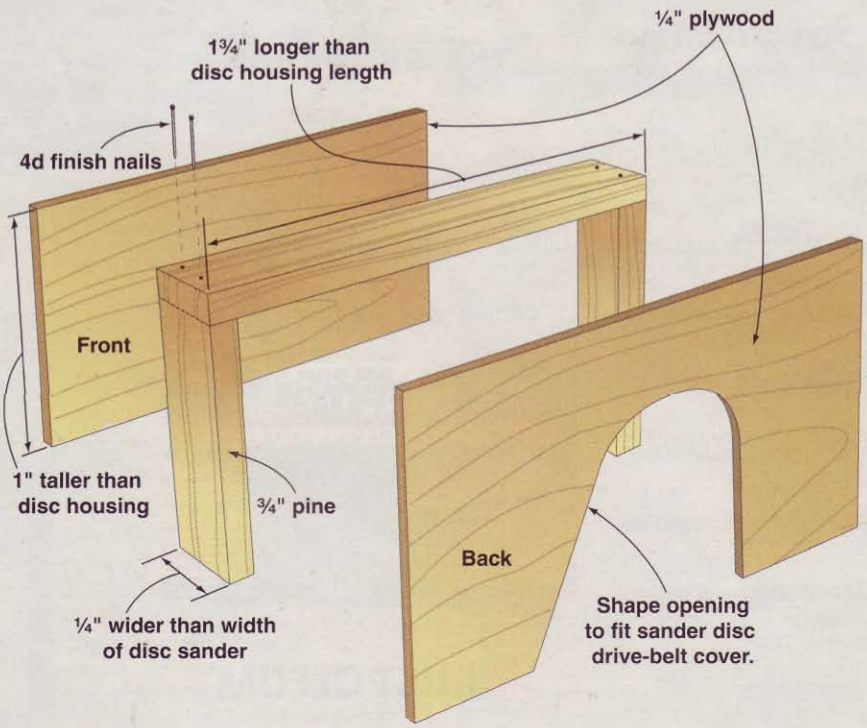
Shield takes the worry out of being close

top shop tip

When I use the belt on my belt/disc sander, it makes me a bit nervous to have the disc spinning there while my attention is focused elsewhere. To avoid inadvertent damage to my hide and hobby, I built the shield shown out of scrap plywood and pine, first nailing the frame together, then gluing the front and back panels to it.

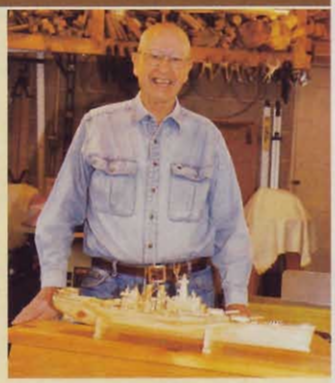
The shield rests on the sander's table without fastening, and I've never had a problem with it rubbing on the disc for more than a second. The only time I remove it is to use the disc sander; otherwise, it stays in place to protect the disc and my hands.

—David Evans, Roy, Utah



Continued on page 32

Our Winner



Kathy Montieth, KTM Photography

As an ex-Navy man who dabbles in woodcarving, Dave Evans thought it might be fun to carve a scale model of the battleship USS *Missouri*. Two hundred hours and a pile of chips later, the ship emerged from a block of quaking aspen. "Next thing I knew, everybody wanted one," our Top Shop Tip winner says. Happy to oblige, Dave has since carved thirteen more ships, from aircraft carriers to destroyers. We're glad he's just as generous when it comes to sharing his workshop wisdom.

Dave Evans wins a Shop Fox 6" jointer (W1679) for sending in this issue's Top Shop Tip. Attaboy, Dave!

Top tips win tools!

Describe how you've solved a workshop dilemma, and you'll earn $75 if it appears here. And, if your tip garners Top Shop Tip honors, you'll also win a tool prize worth at least $250.

Send your best tips, along with photos or illustrations and your daytime telephone number, to: **Shop Tips, *WOOD*® Magazine, 1716 Locust St., GA-310, Des Moines, IA 50309-3023**. Or e-mail tips to: **shoptips@woodmagazine.com**. Remember to include your contact info in the e-mail as well.

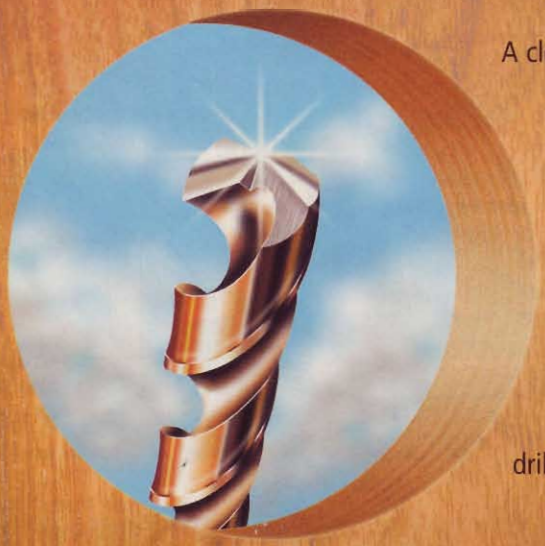
Because we try to publish only original tips, please send your tips only to *WOOD* magazine. Sorry, but submitted materials can't be returned.

Rubbery shelf liner revives pushblocks

My jointer's plastic pushblocks have provided years of durable service. But over time, their rubber pads disintegrated into dust. To revitalize them, I cleaned the blocks and used spray adhesive to re-cover their bases with rubber shelf liner. With the new pads in place, the blocks once again provide grip and make working on the jointer safe.

—Willard Funk, Rochester Hills, Mich.

WANT THIS?



A clean, sharp hole every time. No chips, no splits, no errors. It takes skill and a sharp drill bit. And *that* takes the ***Drill Doctor®*** drill bit sharpener.

GET THIS.

- Restores bits to factory sharp
- Fast and easy to use
- Sharpens most twist bits—even split point
- Diamond sharpening wheel
- Powerful 20,000 rpm motor

Drill Doctor®
The Drill Bit Sharpener

Drill bits are meant to be sharpened

www.DrillDoctor.com • 1-888-MYDRILL

"I have never recommended a product that was so easy to use and so effective. This is one of the best tools I've ever purchased."

–Stephen Bierhorst
Patterson, Louisiana

Available at Home Depot, Lowe's, Sears and wherever fine tools are sold

Circle No. 1511

"Cheater" bar aids drill-press belt tensioning

After changing speeds on my drill press, my hand kept hurting whenever I would retension the belt with the small tension handle. The solution was to make an old-fashioned "cheater" bar to extend the handle. To make it, cut a 6" piece from a 1" hardwood dowel. Drill a 2"-deep hole in one end to slide over the handle, and round the other end to make it more comfortable. The extra 4" of length provides more leverage, and my hand doesn't hurt anymore.

—Raymond Ky, Rosemead, Calif.

Continued on page 35

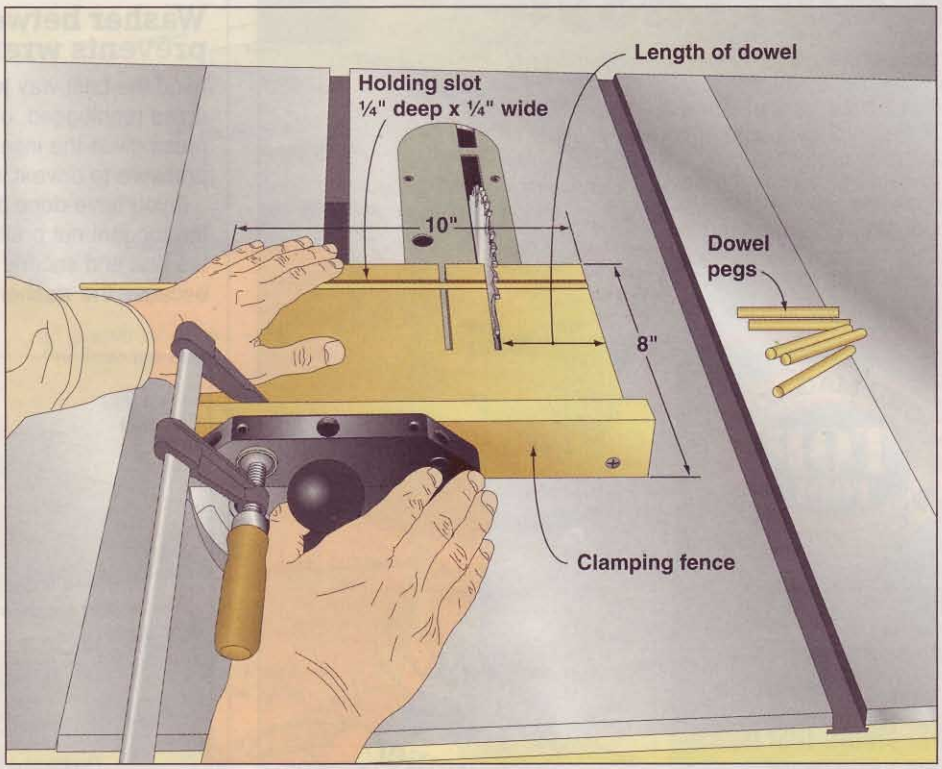
Dowel jig has perfect cuts pegged

I needed a number of same-length dowels for a recent project. To keep my hands away from the tablesaw blade while cutting these, I made a dowel-cutting sled that allows me to make multiple cuts of identical lengths safely and accurately.

First, I cut a ¼" slot ¼" deep across the sled that safely holds dowels from ¼" to 7/16" in diameter. Next, I attached a 1×2 clamping fence to the sled as shown, and clamped it to my miter gauge so that the distance between the right-hand edge of the sled and the saw blade equaled the length of the dowel I wanted.

To make multiple dowels, I slide the dowel stock so that it's flush with the edge of the jig, make the cut, and then back the sled out of the blade. Sliding the dowel stock to the end of the sled again safely ejects the cut-off dowel and readies the next cut. You can cut additional kerfs in the sled, if you like, for different lengths of dowels as needed.

—David Ramsey, Cleveland, Tenn.



Continued on page 36

NEW

The fastest way to join wood just got more precise...

Before joining your project with the simplicity and strength of Pocket Hole Joinery, you must cut your workpieces accurately.

Introducing, KREG Precision Measuring Systems. Woodworking machine accessories that help you to cross-cut your workpieces with more speed and repeatable precision than ever before. Perfect for the miter saw, tablesaw, drill press, and more.

Visit www.kregtool.com today for more details.

2. Drill Pocket Holes

3. Join wood

1. Cut square

Flipstop

Production Stop

Trak

Precision Miter Gauge System

Kreg™

www.kregtool.com
800.447.8638

The Blue Mark of Quality.

Dust Collection Made Easy!

"...the unit's performance is exceeding my wildest expectations. Pickup is tremendous. It is obvious that the Oneida piping design provides optimum performance. There is no doubt in my mind that I made the right decision in choosing Oneida over the other cyclone systems currently on the market."

Bill Wilson - Pennsylvania

WOOD MAGAZINE TOP TOOL APPROVED 2003

Made in the USA

1.5 - 25hp Systems

Filter Media Test Rated*

Captures 99.9% of 1 micron wood dust @ 2.5" H_2O

* See independent lab tests on website.

End of Summer Specials! Call for Details.

Source Code: W904

See Us at IWF 2004 Booth 8641

Circle No. 2039

FREE Catalog!

Ductwork Design Service

It's critical to efficient dust collection!

Photo Courtesy of Cabinetmaker Magazine.

Oneida Air Systems

Order On-Line!

www.oneida-air.com

Call Us Today! **1.800.732.4065**

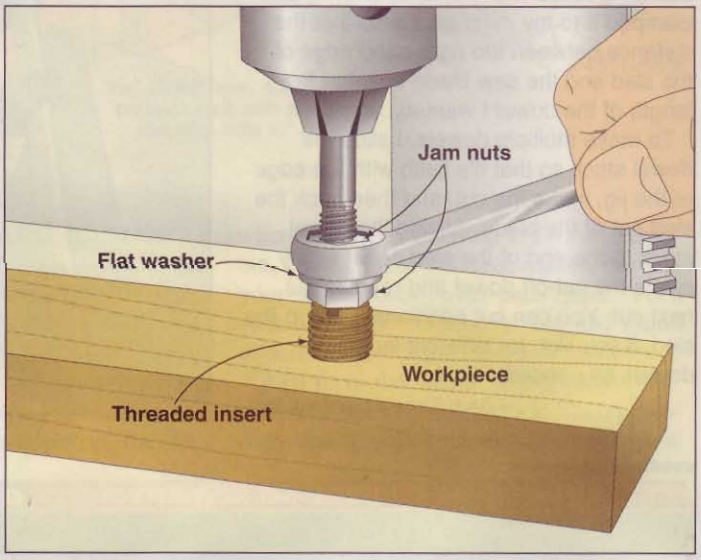
shop tips

Washer between jam nuts prevents wrench slippage

I find the best way to install threaded inserts is to use my drill press (unplugged, of course) as a heavy-duty manual press. The press gives the insert a straight start and supplies enough pressure to drive it into harder woods.

If you have done this before, you know that the wrench slips off the top jam nut pretty easily, so I placed a flat washer between the first and second jam nuts. The wrench can't slip off the nut, because the washer blocks it.

—Perry Johnson, Golden Valley, Minn.

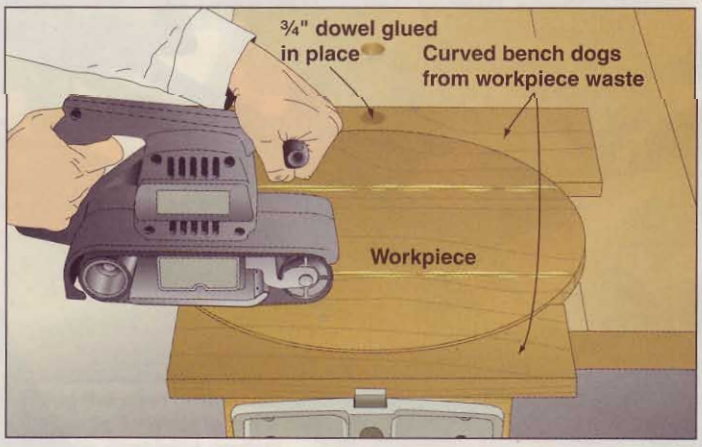


For best in show, use a custom bench dog

Curved workpieces always present sanding and clamping challenges. Clamps have to be moved around and square bench dogs can dent the workpiece. To avoid this dilemma, I make custom bench dogs when possible from the workpiece waste.

To make the bench dog, drill a ¾" hole into the waste piece, glue a short ¾" dowel peg in place, and pop it into your workbench. Save a smaller waste piece to use as a clamping block on your bench vise.

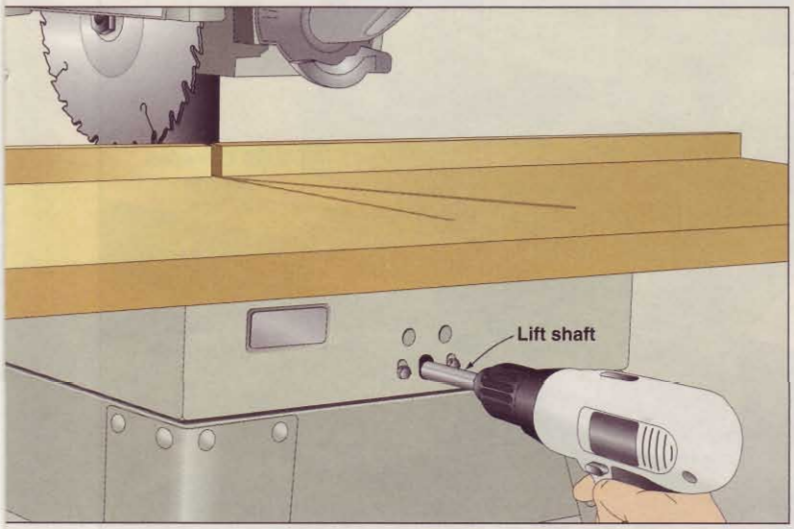
—Doug Stewart, Ottawa



Power lift replaces hand-operated cranks

Not long ago, while lifting the blade and motor of my radial-arm saw, the crank handle broke off in my hand. To keep the work going, I chucked my cordless drill onto the lift shaft and gave it a test-drive. My new "power" lift works so well I haven't bothered to replace the crank handle.

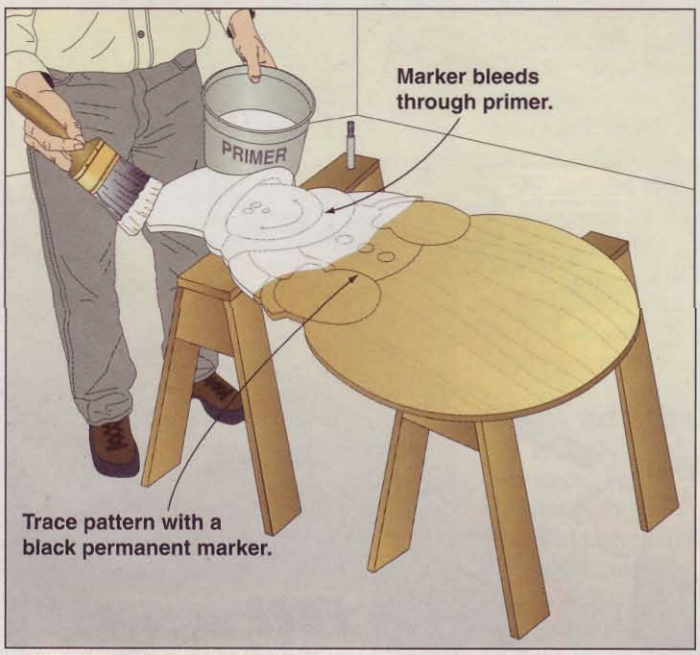
—Charlie Hulien, Sun Valley, Calif.



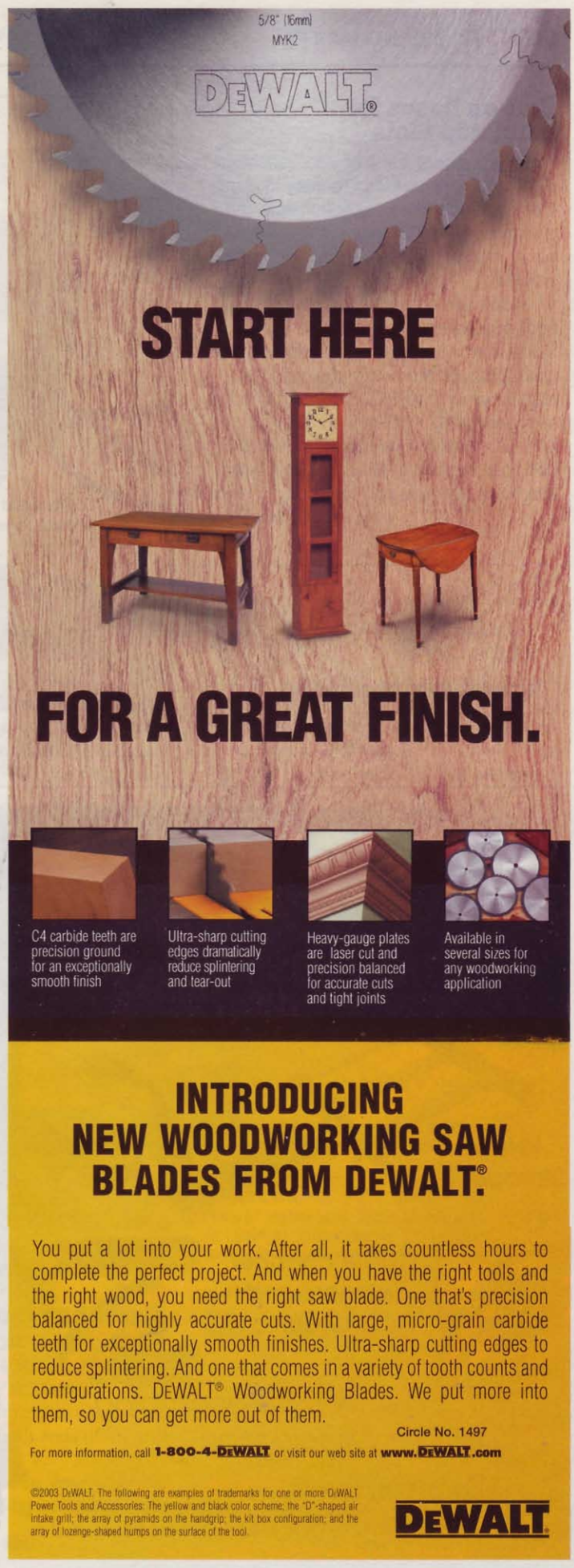
Keep coloring inside the lines

My grandchildren and I like to make the lawn-ornament projects from *WOOD Plans*®; after I cut out the parts, the kids paint the ornaments. To help my little partners with the process, I first draw the ornament details on the wood with a permanent black marker before applying a water-based latex primer. The marker bleeds through the primer just enough so that the kids have a pattern to follow when they apply the colored paints.

—John Zolyniak, Charleston, S.C.



Continued on page 38


5/8" (16mm)
MYK2
DEWALT®
START HERE
FOR A GREAT FINISH.
C4 carbide teeth are precision ground for an exceptionally smooth finish
Ultra-sharp cutting edges dramatically reduce splintering and tear-out
Heavy-gauge plates are laser cut and precision balanced for accurate cuts and tight joints
Available in several sizes for any woodworking application

INTRODUCING NEW WOODWORKING SAW BLADES FROM DEWALT®

You put a lot into your work. After all, it takes countless hours to complete the perfect project. And when you have the right tools and the right wood, you need the right saw blade. One that's precision balanced for highly accurate cuts. With large, micro-grain carbide teeth for exceptionally smooth finishes. Ultra-sharp cutting edges to reduce splintering. And one that comes in a variety of tooth counts and configurations. DEWALT® Woodworking Blades. We put more into them, so you can get more out of them.

Circle No. 1497

For more information, call **1-800-4-DEWALT** or visit our web site at **www.DEWALT.com**

©2003 DeWALT. The following are examples of trademarks for one or more DeWALT Power Tools and Accessories: The yellow and black color scheme; the "D"-shaped air intake grill; the array of pyramids on the handgrip; the kit box configuration; and the array of lozenge-shaped humps on the surface of the tool.

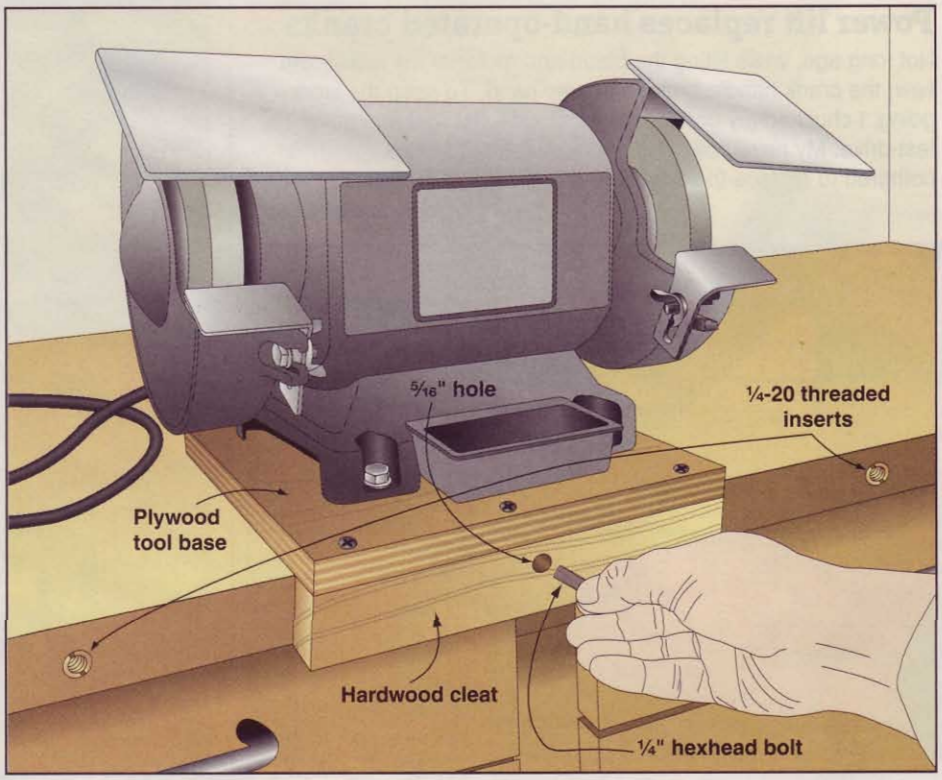
DEWALT

Bolt-on bases for benchtop tools

When you mount some of your benchtop tools on plywood bases, it's easy to clamp them to the benchtop. Unfortunately, the clamps can block access to the top drawers in your bench. Here's how I solved the problem.

I added a ¾×2" hardwood cleat to the front edge of each tool base, as shown *below*, with a 5/16" hole in the middle of the cleat. Through the hole in the cleat, I marked several spots along the front edge of my benchtop where I then installed ¼-20 brass threaded inserts. A ¼" hexhead bolt goes through the cleat into the insert, and holds the base and tool firmly in place.

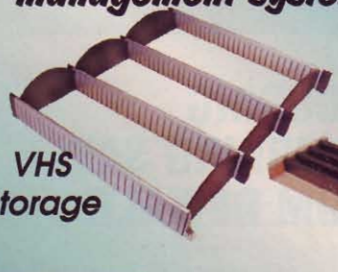
—Jonny Krup, Oxnard, Calif.



See a new Shop Tip of the Day at **woodmagazine.com/tips**

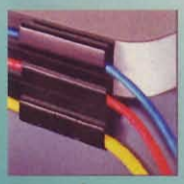
Amerock®

Finish your entertainment center with Amerock media storage and cable management systems



VHS Storage

CD/DVD Storage



Cable channel, runners and conduit

Check our website or catalog for full selection

Circle No. 713

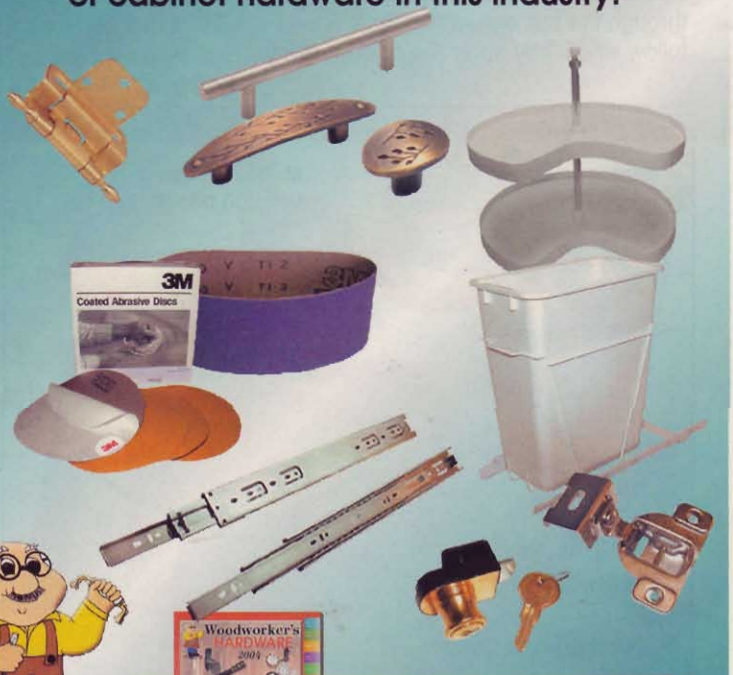
Woodworker's Hardware

PO Box 180 Sauk Rapids, MN 56379

1-800-383-0130, FAX 1-888-811-9850

www.wwhardware.com

With over 8,000 items in stock, we are the home of the largest selection of cabinet hardware in this industry.



***FREE** 300 page full line catalog*

Mention offer #406

our editors test tool casters

Why buy?

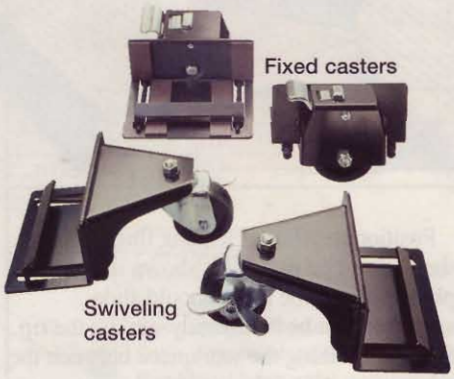
With a myriad of mobile bases available for stationary power tools, we thought you might like to know about a couple of lower-cost alternatives in workshop transportation: tool casters. These four-wheel sets attach directly to the base of a stationary tool, make for easy tool movement, and with a flick of the toe prevent the tool from moving during use. The casters come ready to install out of the box, and you won't need to borrow a buddy before going mobile: You mount them without lifting the tool.

Jet JMB-CTR, $60

Editor test-drive:

Jet's Clamp-On casters install anywhere around the perimeter of most closed-base stationary tools, such as a cabinet-style tablesaw or jointer. By putting them near the corners on the front and back of my 6" jointer, I effectively broadened its base to make it more stable—the same way outriggers stabilize a canoe. I put another set on my 550-lb cabinet saw, and went mobile through a hefty pile of sawdust and over the soft floor mats in my shop with no difficulty. The casters do add height to the saw, though, making it ¾" taller than my outfeed table.

Installation couldn't be easier, with no drilling. Simply tilt the tool, slip the caster under the base, then tighten two bolts until they clamp tightly onto the base. The bolts are long, so I closed the clamps by hand to get them close before tilting the tool for final installation. The set includes two swiveling and two fixed casters. Step on the lock to prevent rolling, lift with a toe to release.



Bottom line: Excellent for closed-base tools.

—Tested by Jim Pollock, Techniques Editor

To learn more:

800/274-6848, wmhtoolgroup.com

Woodcraft Retracting Casters (#141550), $40

Editor test-drive:

Unlike a mobile base or locking casters, these retractable casters swing up and out of the way when not in use, so the tool rests solidly on its own legs. This also keeps the tool at its normal working height. The spring-assisted casters raise and lower with light foot pressure, and the ball-type wheels glide smoothly and quietly, even across the uneven areas of my concrete shop floor.

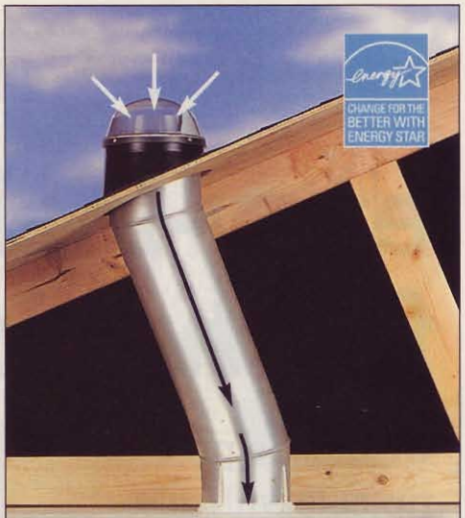
Although marketed primarily for use with contractor-style tablesaws, Woodcraft's Retracting Casters work well with virtually any stationary tool with a splay-legged open stand that weighs less than the casters' 400-lb weight limit, such as a radial-arm saw or drum sander. I bolted a set of these casters onto the steel legs of my portable-planer stand in about 30 minutes, including drilling the mounting holes. Because of their retracting design, I mounted the casters without ever having to tilt the stand.

Bottom line: Perfect for open-stand machines.

—Tested by Owen Duvall, Projects Editor

To learn more:

800/225-1153, woodcraft.com



LET THE SUNSHINE IN.

Does the lack of sunlight in your home have you feeling down? Now you can experience the warmth and joy of beautiful, natural sunlight anywhere in your home.

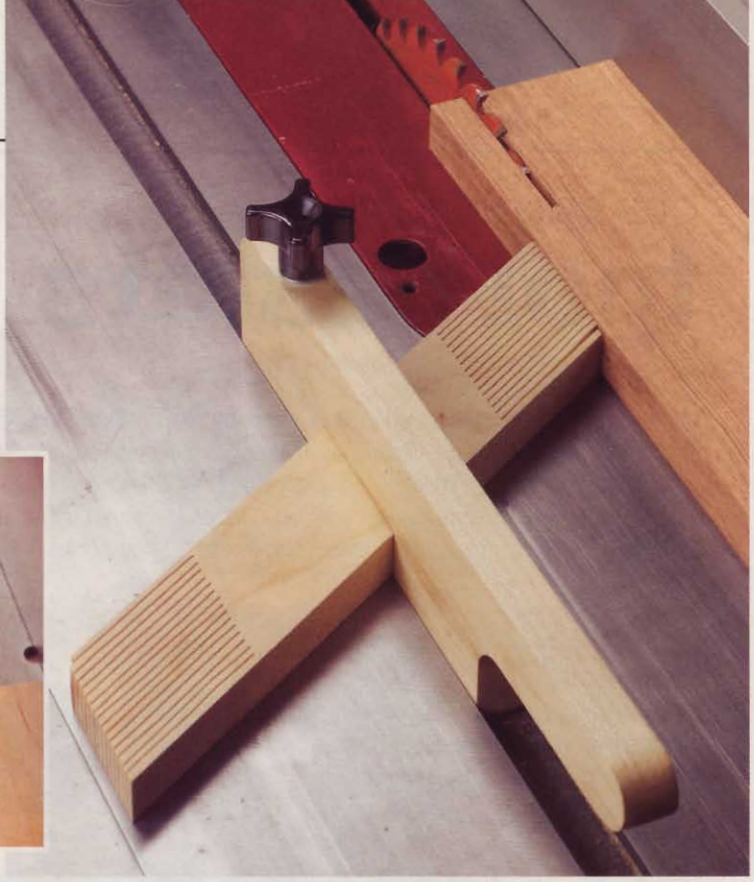
Solatube skylights capture and redirect sunlight to areas that need it most. Make your day at home as enjoyable as a day outdoors. **Call for free information or a dealer near you. Code 1050.**

1-800-966-7652

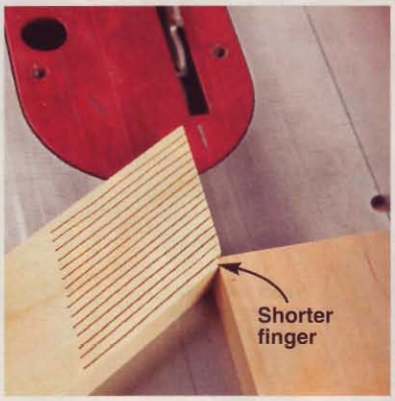
www.solatube.com

SOLATUBE
The Miracle Skylight

easy-lock feather board



Guarantee perfect rip cuts with this quick-to-set tablesaw helper.



When ripping stock on your tablesaw, keep it firmly and safely against the fence with this handy adjustable locking feather board. Not only does it prevent wavy cuts, it guards against dangerous kickback.

To build one, use the drawing at *right* and the full-size patterns on the *WOOD Patterns*® insert to cut handle (A) and feather board (B) to size and shape, noting the location of the angled notch and counterbored hole in the handle. Use a bandsaw to cut the 2½"-long kerfs in the feather board and the curved portion of the handle, where located on the pattern. Cut the 30° angled notch in the handle's bottom edge using a dado blade in your tablesaw along with an auxiliary wood fence on your miter gauge for support.

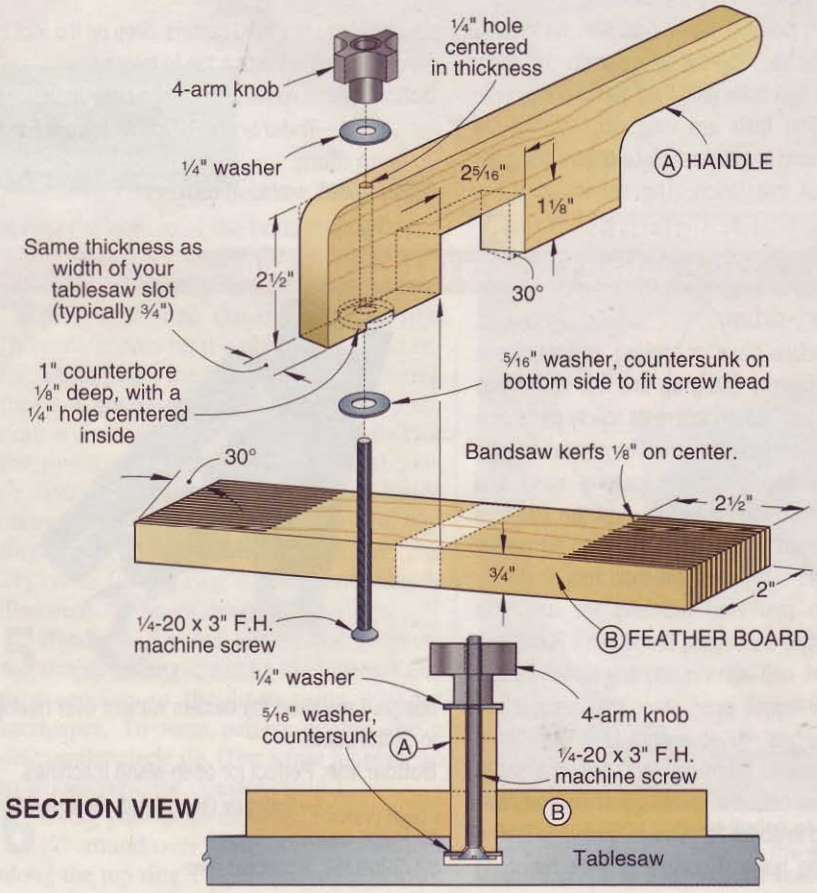
To finalize the feather board, countersink and slide a 5/16" washer onto the head of the machine screw, slide the threaded end through the handle, and fit a washer and 4-arm knob onto the end. Fit part B into the angled notch, and slide the bottom edge of the handle and the washer into the miter-gauge slot on your tablesaw where shown on the **Section View**. If the washer is too wide for your miter-gauge slot, you may need to grind down the outside edges for a good fit.

Using the feather board

With the saw off, slide the workpiece between the feather board and fence. Position the trailing edge of the feather board about 1" in front of the leading edge of the saw blade, where shown in the photos *above*. Put too close to the blade, the feather board can pinch the kerf and cause the workpiece to bind on the blade.

Position the shorter leading finger against the piece to be ripped, as shown in the inset photo *above*. The piece should slide smoothly, yet be held firmly against the rip fence. If pushing the workpiece between the feather board and rip fence offers too much resistance, back part B off slightly. Once properly positioned, tighten the 4-arm knob to secure the assembly in place.

Project design: **Vernon Lee; Scott Spierling**



show off figure with dye

Quilted maple and other figured woods gain depth as well as brilliant color when you choose this type of stain. Here's everything you need to know for success.

If you've used commonly available, premixed canned stains for years with good success, you may be wondering "Why use dyes? Who needs 'em?" Well, you may. Compared to pigmented stains and pigment/dye mixes—what you typically find on hardware store shelves—dye produces a clearer appearance that shows off the grain much better. The difference really stands out when you dye dense wood that doesn't accept stain well or figured wood, such as the curly maple we used to build the jewelry boxes on *page 88*. Stain tends to create a bland look on figured wood, while dye gives the surface an attractive undulating appearance. See the photo *below* for examples.

Stains and dyes produce different looks because they color wood in different ways. Pure pigment stains only partially penetrate the wood, doing most of their coloring by lodging in tiny surface cracks and pores. If the wood is dense and smooth, like maple, pigment particles find few places to rest. Gel stains are thicker than standard stains and form a film on the surface with very little penetration. They prevent blotchiness but also obscure the grain. Dye, however, dissolves completely in its solvent, goes wherever the solvent can penetrate, and actually changes the color of wood cells. It allows the grain to clearly show through. Some stains contain both dye and pigment, but the combination doesn't solve the problems presented by dense woods.

COLORING CURLY MAPLE

When to choose dye

Steve Mickley, host of our finishing forum at woodmagazine.com, offers these recommendations for the best results.

USE DYE OR STAIN:	USE DYE:
Ash	Alder
Mahogany	Birch
Oak	Cherry
Walnut	Maple
	Pine
	Poplar

Consider your dye options

Dyes are sold in liquid and powder form, and every dye is designed to dissolve in one or more types of solvent: water, denatured alcohol, or an oil such as toluol or turpentine. For your first efforts with dye, buy water-soluble powder for ease of use, reliable results, and good resistance to fading.

Dyes are available at woodworking stores, on Web sites, and from mail-order catalogs. We've had good results with powdered dye from W.D. Lockwood & Co., available in 1-ounce packets priced between $3 and $4, depending on the color. Call 866/293-8913 to order, or visit wdlockwood.com.

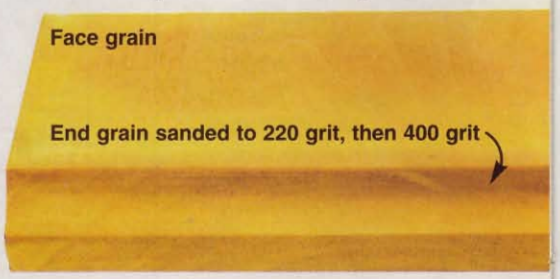
No matter how you color the wood, the end grain of any wood species presents a uniformity problem because it soaks up more dye or pigment, resulting in a darker color compared to face- and edge-grain surfaces. To produce a more consistent appearance, try one of two methods shown *below*. Before staining, sand the end grain with a finer grit than used on the rest of the wood, or seal the end grain with premixed shellac thinned 50/50 with denatured alcohol and lightly sand with 220-grit sandpaper after the shellac dries.

Let's apply some dye

Here's how to proceed with water-soluble dye, the type we prefer in most instances. When your project or its parts are ready to finish, sand the wood as usual and then raise the grain by wiping it with a water-dampened cloth. Let the project dry overnight, and then sand lightly with 320-grit sandpaper.

TWO END-GRAIN TREATMENTS

Note: All face grain sanded to 220 grit



Continued on page 44

BREW UP A NICE BATCH OF DYE

Boil water, let it cool for 1 minute, and add powdered dye in the ratio of 1 ounce per *quart of water. Let it cool before application.*

Mix the dye thoroughly and pour it through a coffee filter, as shown here, or pantyhose. *This step removes undiluted lumps of dye.*

This method prevents tiny wood fibers from rising again after you apply the dye.

Next, mix dye as shown in the photos *above*. Use a glass or plastic container, and prepare more than enough dye to complete the job so you don't apply mismatched tones from two separate batches. Test the result on scrap that matches your project.

Use a foam brush or a common household sponge to apply water-soluble dye on wood, working in any direction. Flood the surface as quickly and evenly as possible to prevent lap marks and streaks. Also avoid drips on untreated areas. Coat the entire project at the same time. When possible, break large pieces into component parts, or apply dye prior to assembling project parts, to keep your dyeing area at a manageable size. When the surface is covered, wipe it immediately with a soft cloth to remove excess dye as shown *below, left.*

Fine-tune the result

If the tone looks darker than you planned, it's best to lighten it immediately. See the basic technique in the photo *below, right.*

In extreme cases, when the result is far from what you expected, it's possible to return to the starting point. Lighten the dye with water, and then remove the rest of it from the wood with common household bleach containing chlorine.

If you want to darken the result of your initial dye application, do so with another coat of the same mixture or make a stronger batch and apply that.

Change tactics for alcohol-soluble dyes

If you decide to try alcohol-soluble dyes, keep these pointers in mind:

- Mix them in denatured alcohol—not rubbing, or isopropyl, alcohol—available at hardware stores and home centers. DO NOT heat this flammable solvent.
- Spray alcohol-soluble dyes to avoid streaking caused by the solvent quickly flashing off. Use a spray gun powered by compressed air or handle small jobs with a unit such as the Preval spray system. Available at home centers for under $4, it consists of a 6"-long pressurized sprayer and a detachable glass jar. Order it online by going to dickblick.com.
- To color pine, a notoriously blotchy wood, Steve Mickley recommends mixing alcohol-soluble dye with shellac and spraying this toner mixture on the surface. The tinted shellac forms a film on the wood instead of soaking in.

Once you become familiar with dyes and the colors they produce, experiment with color adjustment. After dyeing a surface, add a different-color dye to produce a combination of the two. For example, apply red to warm up a cool wood-tone color or add blue to cool down a warm tone.

When the color looks perfect, let the dye dry completely. Drying dulls the appearance of a dyed surface; a clear topcoat restores the color and shine that you saw in the wet dye. Use any topcoat over dye, but be careful if you choose a water-based finish. Brushing water-base over water-soluble dye tends to redissolve the dye and pull it up into the finish, creating a muddy look. Spraying eliminates this problem.

WIPE ON, REMOVE THE EXCESS, AND LIGHTEN IF NECESSARY

Guarantee an even distribution of dye by wiping off the excess. If you apply the dye with a sponge, wring it out and use it for this step.

A moist cloth lightens the color even after the dye has dried, but you get quicker results if you act while it's still wet.

Put yourself in the running for a household Oscar, Grammy, and Emmy by building this award-worthy center for your movies, music, and television.

Four separate components—a pair of tower cabinets, a TV stand, and a bridge—give this entertainment center maximum flexibility. Designed to accommodate TVs up to 35" tall and 44" wide set on the stand (or 55" tall and 54" wide set on the floor), you can build just the components that fit your needs. (See the drawings on the next page.) The entire suite, shown *right*, occupies 96" of wall space and stands 59" high, providing plenty of room for all your electronic components as well as storage for CDs, VHS tapes, and DVDs.

Then if you wish, coordinate the whole room by building a matching coffee table and end tables. (The TV stand plan on *page 54* doubles as the coffee table plan. See *page 66* for the end table plan.) All the furniture pieces have common parts and machining steps for ease of construction. To save time, choose the ones you'll build, and machine similar parts at the same time.

Tower cabinet, see *page 48*

entertainment

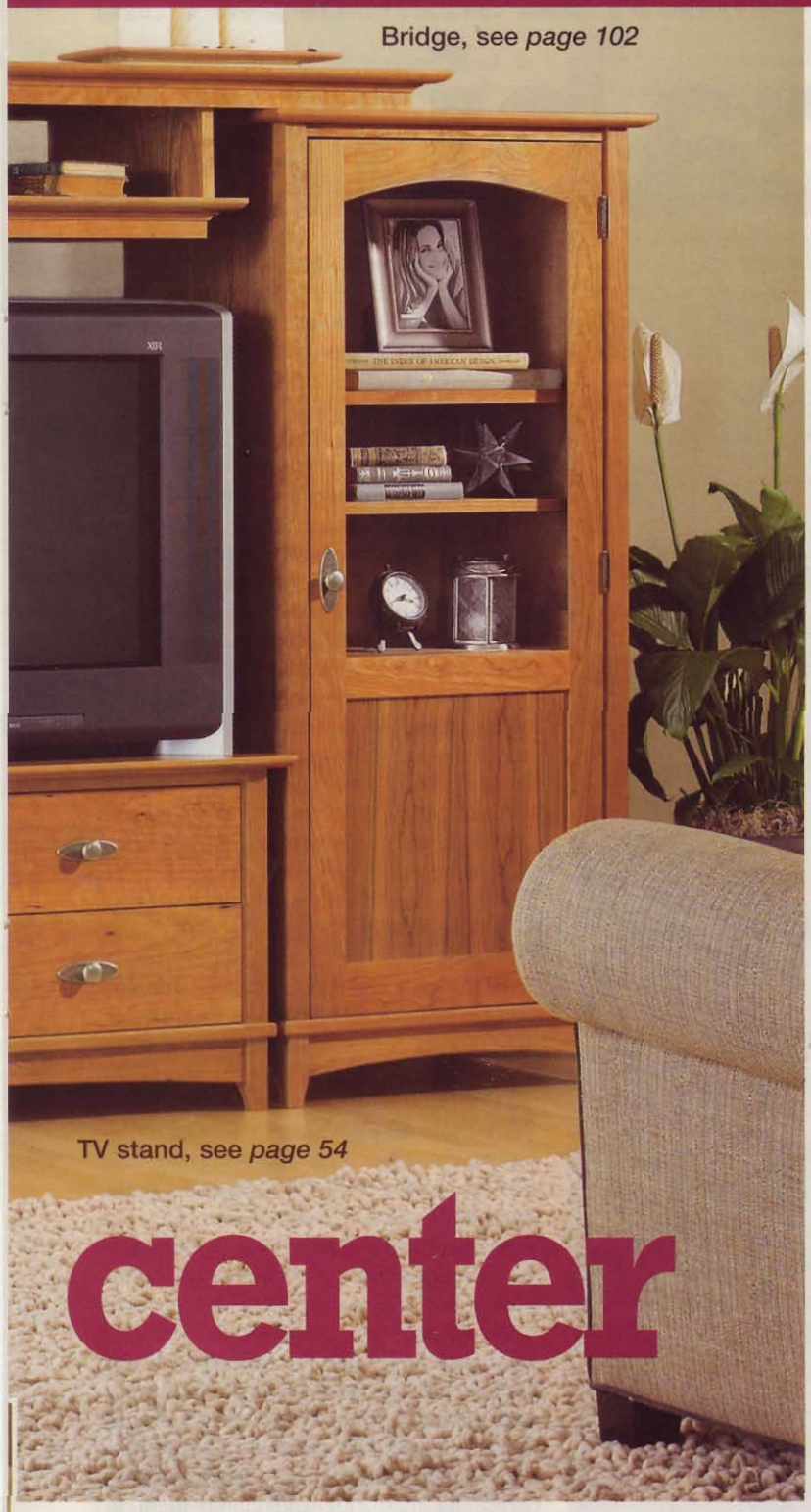
Among the features of this versatile project is the many ways it can fulfill your furniture needs. Build all the pieces and group them as shown, above, or build just the ones you need.

Substitute glass shelves for the wood ones in the tower cabinet, above, and add an interior light, and you have a display case with storage. The TV stand/coffee table, right, is ready to go either way. And we couldn't resist adding a matching end table, far right.

Coffee table, see *page 54*

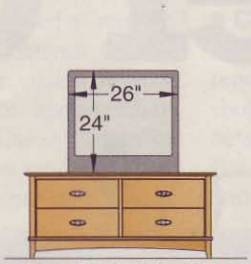
End table, see *page 66*

Bridge, see *page 102*

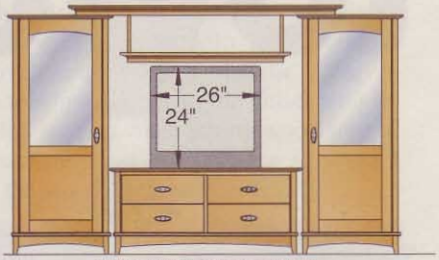


TV stand, see *page 54*

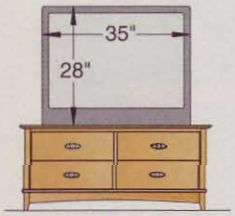
oh-so modular center



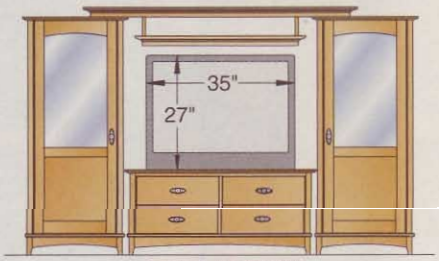
27" STANDARD TUBE



27" STANDARD TUBE



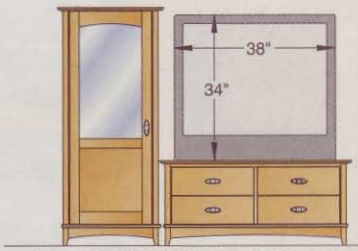
32" FLAT TUBE



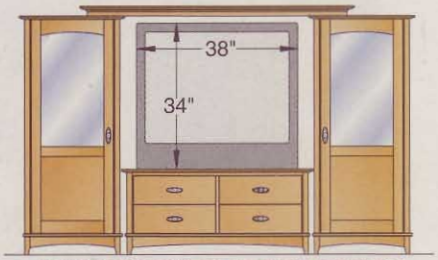
32" FLAT TUBE

TVs come in so many sizes and shapes, it's a challenge to come up with a way to accommodate all of them. By designing this entertainment center as an assembly of independent pieces of furniture, designer Jeff Mertz did just that.

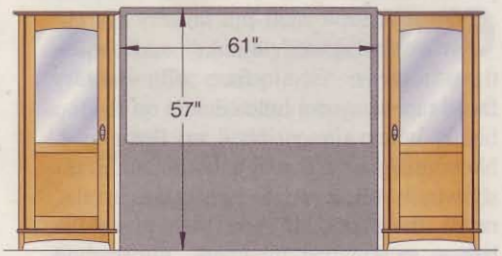
As the illustrations on this page show, you have complete flexibility in the pieces you build and how you configure them to accommodate TV sizes from a small standard tube set to the largest rear-projection models. The optional hanging shelf allows further customization while providing additional space for equipment, storage, or display.



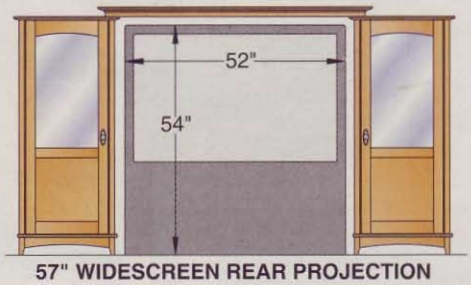
42" TABLETOP REAR PROJECTION



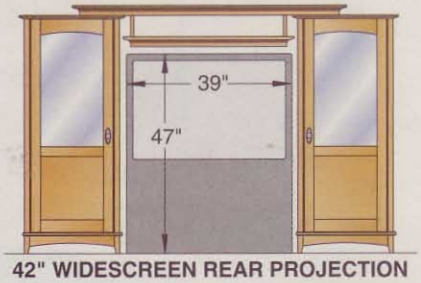
42" TABLETOP REAR PROJECTION



61" WIDESCREEN REAR PROJECTION



57" WIDESCREEN REAR PROJECTION



42" WIDESCREEN REAR PROJECTION

tower cabinet

Note: The **Materials List** *and* **Sources** *list parts to build one cabinet with four adjustable shelves. When building two cabinets, double the quantities, and hinge the doors on opposite sides.*

Start with the sides

1 From 1¾" stock (or laminated ¾"-thick stock), cut the stiles (A) to the size listed on the **Materials List** on *page 53*. Then cut the lower side rails (B), upper side rails (C), lower back rail (D), and upper back rail (E) to the sizes listed.

2 Measure the actual thickness of the ¼" plywood for the panels (F, G), and cut grooves for the panels and rail stub tenons in the stiles (A) and rails (B, C, D, E), where shown on **Drawings 1**, **2**, and **3**. (See the **Shop Tip**, *below right*, for information on different types of ¼" plywood.) Then cut ¾" grooves ¼" deep in the front stiles (A) for the stile fillers (Q).

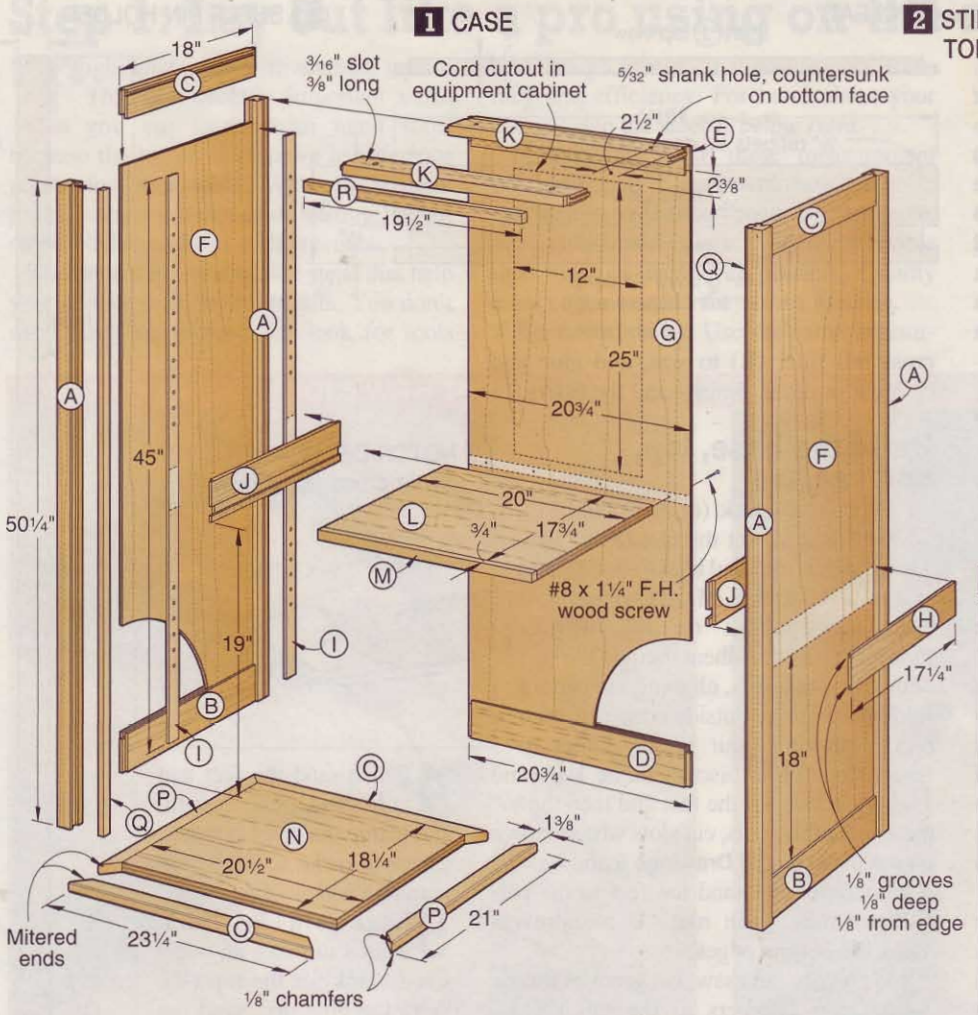
3 With a dado blade, cut stub tenons to fit in the grooves in the stiles (A) on the ends of the rails (B, C, D, E), where shown on **Drawings 1** and **3**. Then cut ¼" grooves ¼" deep in the inside faces of the upper side rails (C) for the stub tenons of the cross rails (K).

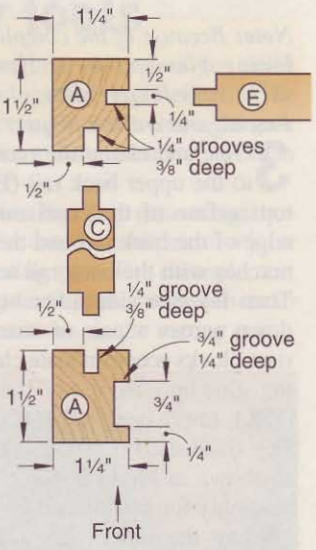
4 Cut the side panels (F) and back panel (G) to size. Finish-sand the stiles, rails, and panels. Then glue and clamp the two side assemblies (A/B/C/F), checking them for square.

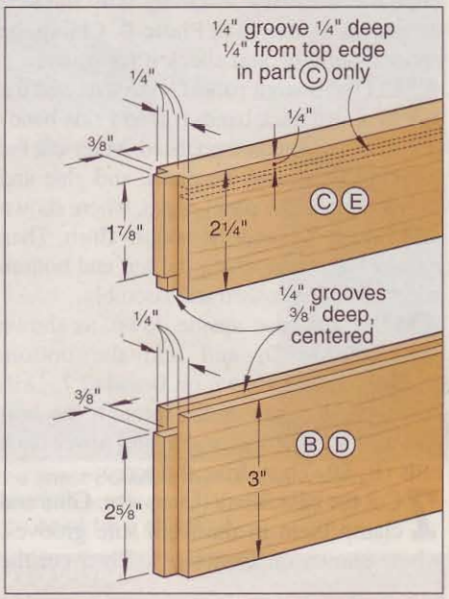
Note: When making two tower cabinets, cut the cord cutout shown on **Drawing 1** *in the back panel (G) of the cabinet that will house the electronic components.*

5 Resaw and plane the trim rails (H) to size. To keep glue from squeezing out when clamping the trim rails in place, cut ⅛"-deep glue-relief grooves in the backs, where shown on **Drawing 1**. Finish-sand the parts, and then glue and clamp them in place, where dimensioned.

6 To make the shelf-pin holders (I), cut two ¾×1¼×45" blanks, and fasten them together face-to-face with double-faced tape. Lay out hole centers on the top blank, where dimensioned on **Drawing 4**. Now drill holes through both blanks, as shown in **Photo A**. Separate the blanks, resaw them in half, and then plane the halves to finished thickness. Finish-sand the shelf-pin holders, and glue and clamp







them to the inside of each side panel (F), where shown on **Drawing 1**.

7 Cut the cleats (J) to size, and rabbet the ends, where shown on **Drawing 5**. Then cut ¾" grooves ¼" deep in the inside faces. Glue and clamp the cleats to the stiles (A) and shelf-pin holders (I), where shown on **Drawing 1**.

Assemble the case

1 Cut the cross rails (K) to size, and rabbet the ends, forming stub tenons to fit the grooves in the upper side rails (C). Make sure the top surfaces of the cross rails and the edges of the upper side rails are flush. Then notch the rails to fit around the stiles (A), where shown on **Drawing 6**. Drill countersunk screw holes in the rear cross rail, and form slots in the front cross rail, where shown on **Drawing 1**.

2 Cut the fixed shelf panel (L) and the fixed shelf band (M) to size. Glue and clamp the band to the panel, keeping the ends and edges flush. Finish-sand the shelf.

SHOP TIP

Plywood that's just right for a ¼" groove

Because veneer-core plywood is only about .198" thick, cutting a ¼" (.250") groove with your stack dado set results in a loose fit, as shown at *right*. To cut the less-than-¼" groove, you'll have to make two passes with your regular saw blade.

In this project, Master Craftsman Chuck Hedlund chose a less labor-intensive approach. He purchased fiber-core cherry plywood from a local lumber yard. This plywood has face veneers bonded to a sheet of medium-density fiberboard. The whole sandwich measures .230" thick, a good fit for the ¼" slot, leaving room for glue.

STACK-DRILL THE SHELF-PIN HOLDERS

Apply masking tape to the top shelf pin holder (I), and mark the hole centers. Chuck a ¼" brad-point bit in your drill press, and drill holes through both blanks.

Note: Because of the complexity of the following glue-up, use a slow-setting glue, such as ordinary white glue or Titebond Extend, and enlist a helper.

3 Glue and clamp the rear cross rail (K) to the upper back rail (E), aligning the top surface of the cross rail with the top edge of the back rail and the cross rail end notches with the back rail tenon shoulders. Then lay one side assembly outside face down across a pair of riser blocks. (The riser blocks accommodate clamp heads during glue-up.) Now add the rail assembly (E/K), lower back rail (D), front cross rail (K), fixed shelf (L/M), and back panel (G), as shown in **Photo B**. Check the side/back assembly for square, and let the glue dry.

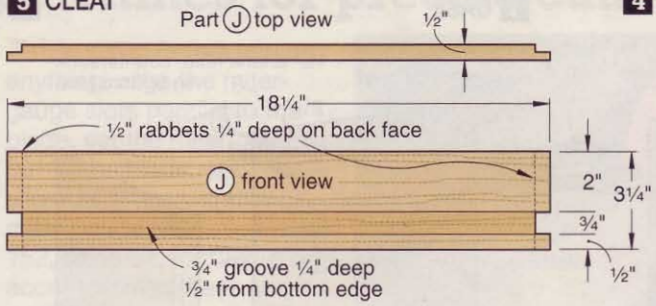
4 Lay the other side assembly outside face down across the riser blocks. Then mate the side/back assembly with the side assembly, as shown in **Photo C**. Clamp the entire assembly, and check it for square.

5 Cut the bottom panel (N) to size, and the front and back bands (O) and side bands (P) about ½" longer than listed. Miter-cut the bands to fit around the panel, and glue and clamp them to the panel edges, where shown on **Drawing 1**. Sand the bottom flush. Then rout ⅛" chamfers along the top and bottom edges, and finish-sand the assembly.

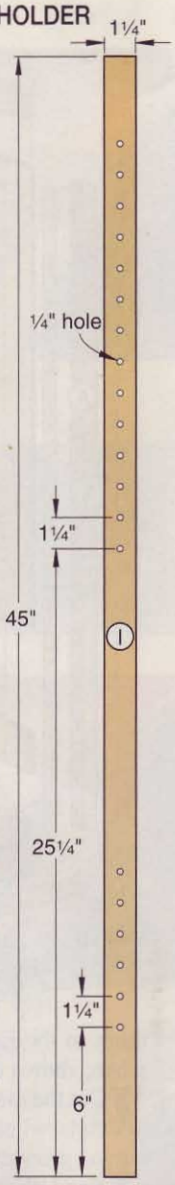
6 Place the case upside down, as shown in **Photo D**, and add the bottom (N/O/P), where shown on **Drawing 7**. Drill countersunk screw holes through the bottom and into the lower side and lower back rails (B, D). Then drive the screws.

7 Cut the stile fillers (Q) to size. Glue and clamp them in the front stile grooves, where shown on **Drawing 1**. Then cut the cross rail filler (R) to size, and glue and clamp it in place. Finish-sand the fillers.

5 CLEAT



4 SHELF PIN HOLDER



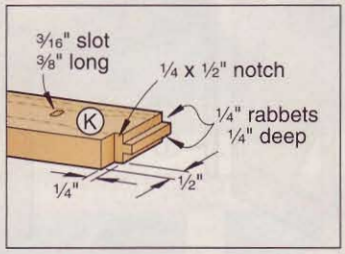
Build the base, top, and shelves

1 From 1¾" stock (or laminated ¾"-thick stock), cut the feet (S) to size. Then cut the front and back rails (T), and side rails (U) to size. Make two copies of each foot pattern on the *WOOD Patterns®* insert. Adhere them to the feet with spray adhesive, aligning the pattern fold line with the outside corner of each foot. Adjusting your biscuit joiner to center slots for #0 biscuits in the 1¼"- and 1½"-wide faces of the feet and then the ¾" thickness of the rails, cut slots where shown on the patterns and **Drawings 8** and **8a**.

2 Bandsaw and sand the feet to the pattern lines. Then rout ⅛" round-overs along the bottom edges.

3 With your tablesaw, cut grooves for the tabletop fasteners in the rail (T, U) inside faces, where shown on **Drawing 8**. Then using a fairing stick, draw the rail arcs. Bandsaw and sand them to shape. (For a free downloadable fairing stick plan, go to woodmagazine.com/fairing.)

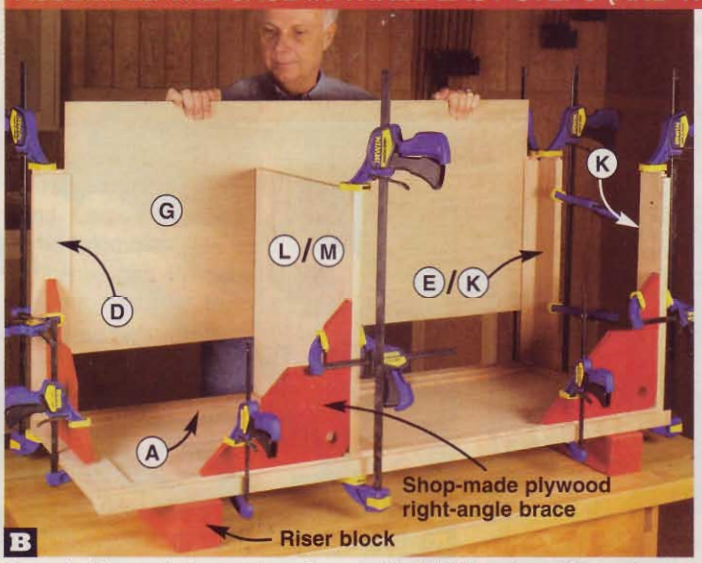
6 NOTCH DETAIL
(Front cross rail shown)



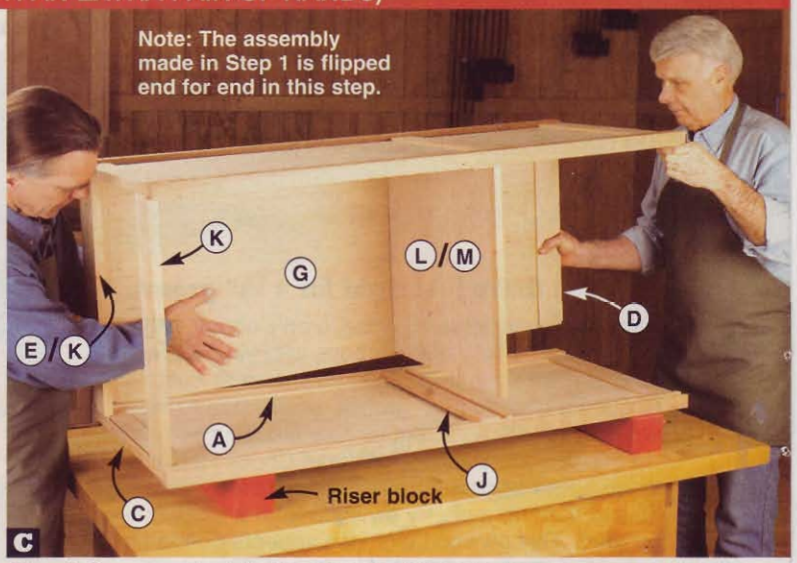
4 Finish-sand the feet and rails; and glue, biscuit, and clamp the parts together. Check to make sure the base is square and sits flat.

5 Edge-join ¾"-thick boards to make an oversized blank for the top (V). With the glue dry, sand the blank smooth and cut it to finished size. Chuck a thumbnail table-edge bit in your table-mounted router, and rout the profile shown

ASSEMBLE THE CASE IN THREE EASY STEPS (AND WITH AN EXTRA PAIR OF HANDS)

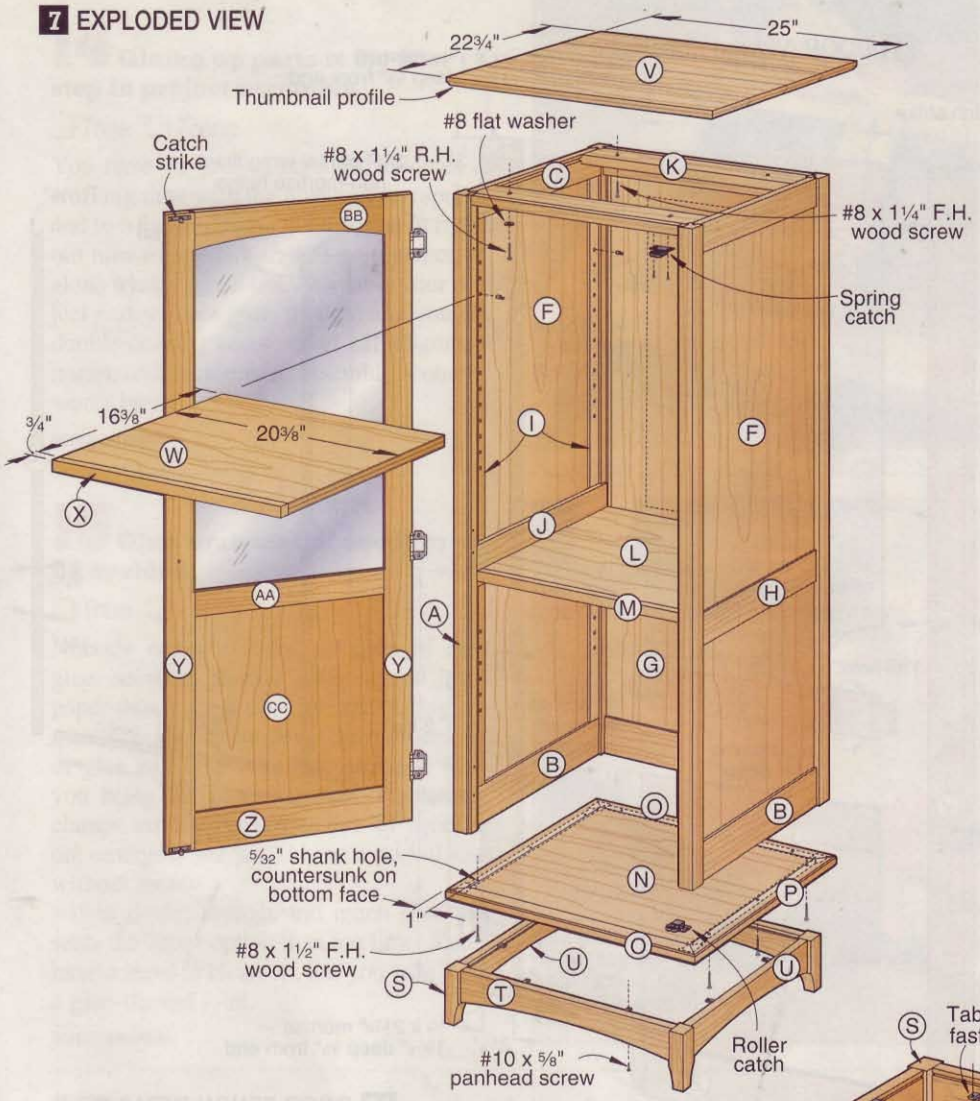


Step 1: Glue and clamp the rail assembly (E/K) in place. Then glue and clamp the rails (D, K) and shelf (L/M) in place, using plywood right-angle braces to hold them square to the side. Now squeeze glue into the rear stile (A) groove, and slide in the back panel (G).



Step 2: Squeeze glue into the grooves of the second side. Then with a helper, pick up the side/back assembly and lower it into place. Starting at the top, seat the rail (D, E/K) stub tenons, back panel (G), and fixed shelf (L/M) in the second side grooves.

7 EXPLODED VIEW



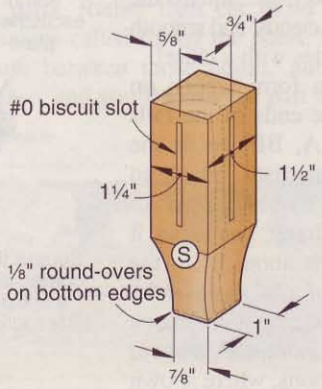
on **Drawing 9** along the bottom ends and edges of the top. Finish-sand the top.

6 Cut the shelf panels (W) and shelf bands (X) to size. Glue and clamp the bands to the panels, keeping the ends and edges flush. Finish-sand the shelves.

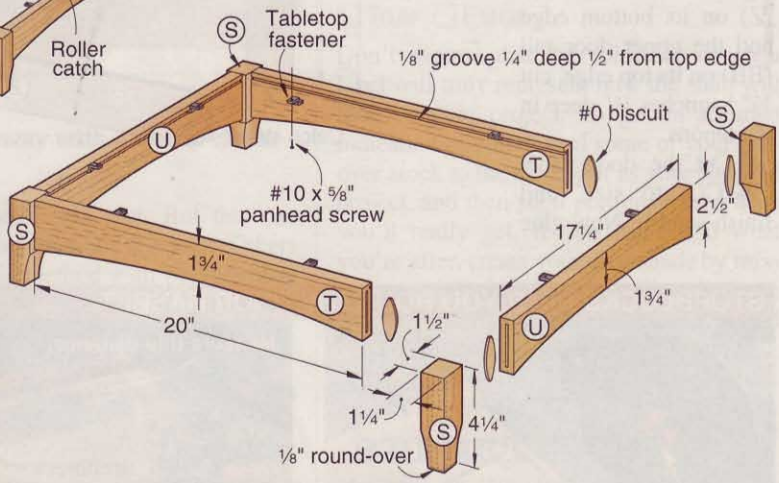
Make the door

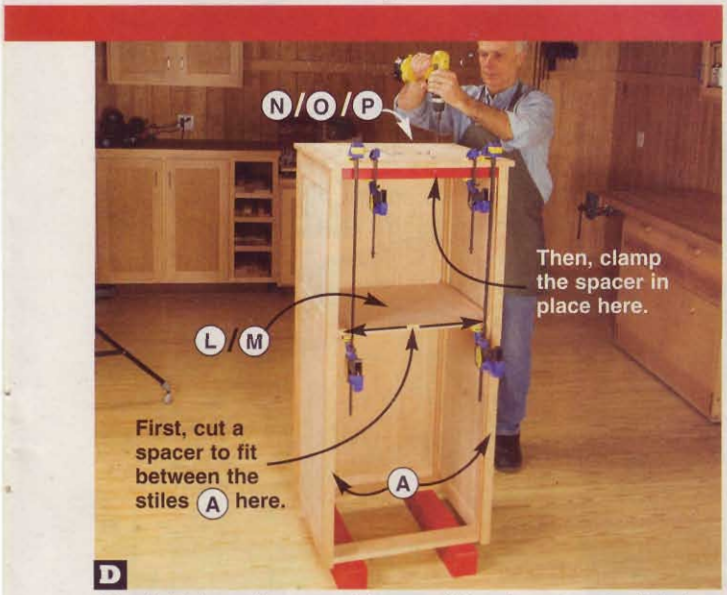
1 Cut the stiles (Y), lower rail (Z), middle rail (AA), and upper rail (BB) to size. Measure the actual thickness of the ¼" plywood for the door panel (CC), and cut cen-

8a LEFT REAR FOOT



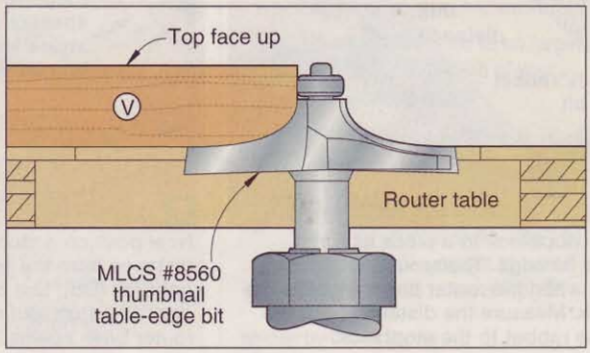
8 BASE





Step 3: To keep the case sides parallel, cut a spacer to fit between the stiles (A) in front of the fixed shelf (L/M), and clamp it in place as shown and described above. Clamp the bottom (N/O/P) to the case, centered. Drill screw holes into the side and back rails.

9 TOP EDGE DETAIL



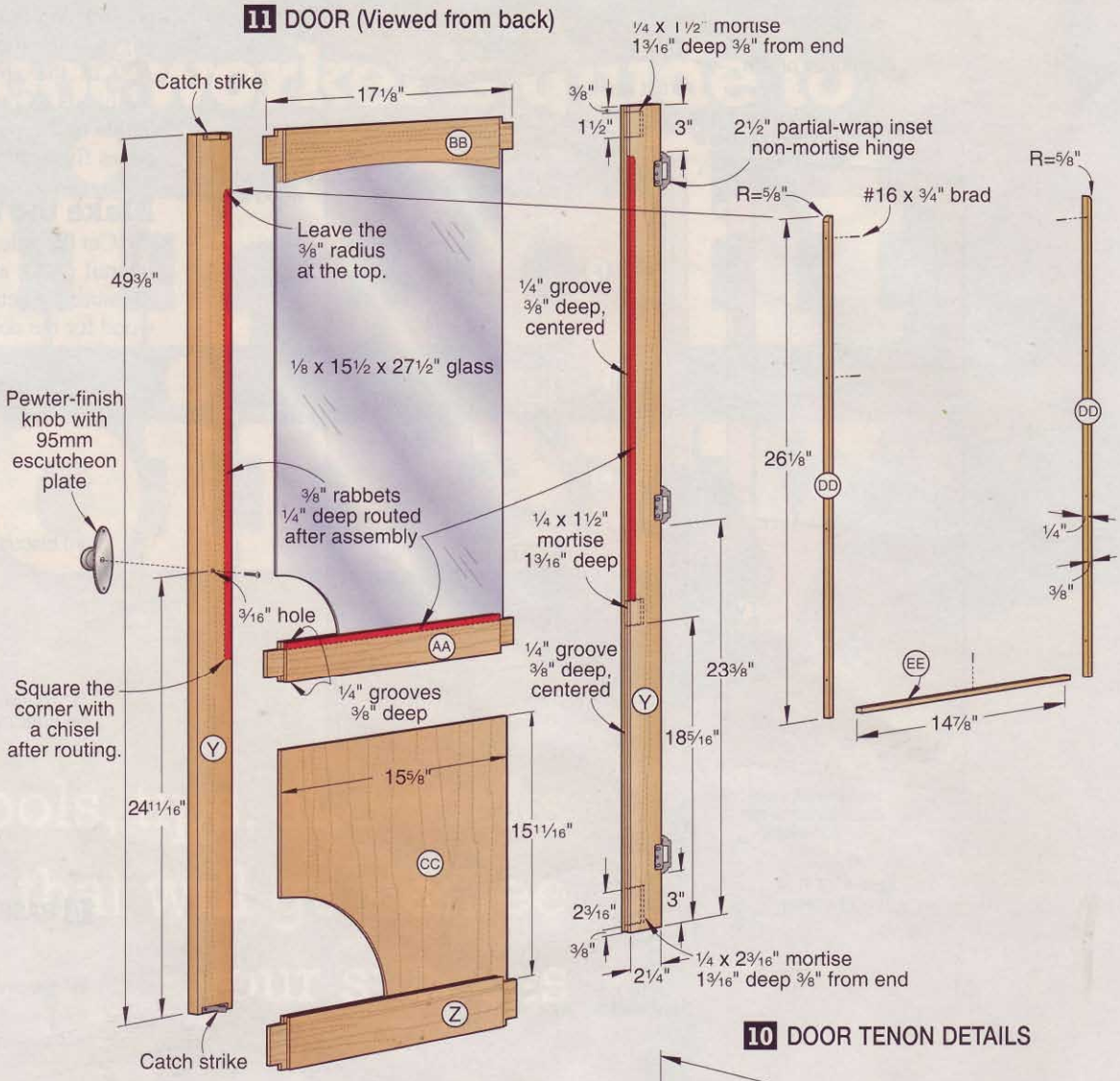
tered ⅜"-deep grooves in the stiles and lower and middle rails, where shown on **Drawings 10** and **11**. Then raise the blade to 1⅛", and cut a groove in the upper rail.

2 Lay out the mortise locations on the stiles (Y), where shown on **Drawing 11**. Chuck a ¼" brad-point bit in your drill press, center it in the ¼" slot, and drill out the mortises. Square the mortise ends, and smooth the sides with a chisel.

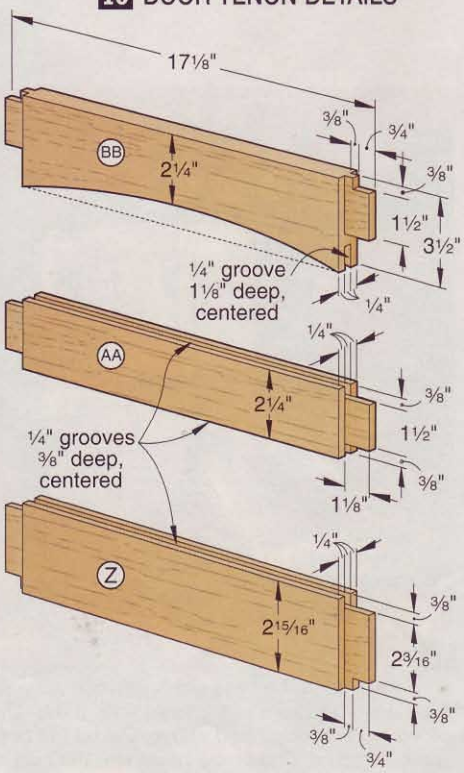
3 To form tenons on the ends of the rails (Z, AA, BB) to fit the stile mortises, attach an auxiliary extension to your miter gauge so it extends about 6" to the right of a ¾" dado blade. Then clamp a stopblock to the extension, and cut the tenons, where shown on **Drawing 10**. Now adjust the position of the stopblock, and positioning the lower door rail (Z) on its bottom edge and the upper door rail (BB) on its top edge, cut ¾" haunches ⅜" deep in the tenons.

4 Cut the door panel (CC) to size, and finish-sand it. Now glue

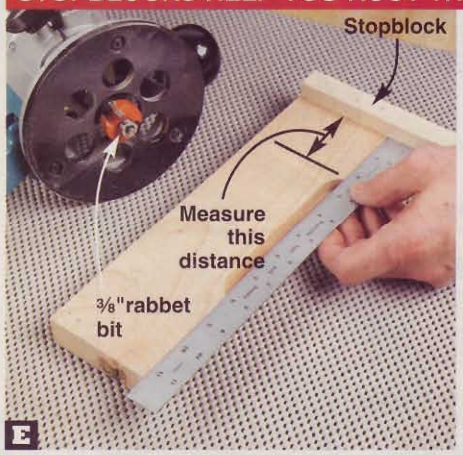
11 DOOR (Viewed from back)



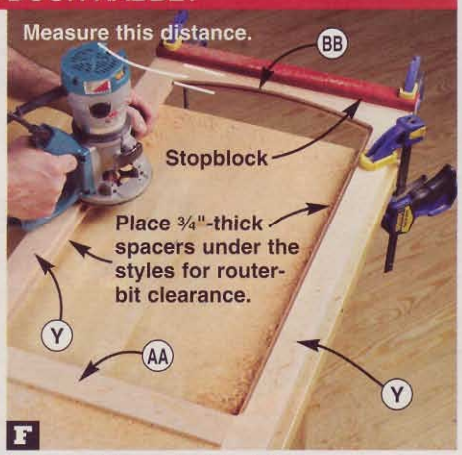
10 DOOR TENON DETAILS



STOPBLOCKS HELP YOU ROUT THE DOOR RABBET



Fasten a stopblock to a piece of scrap, square to its edge. Then rout a ⅜" rabbet, stopping when the router base contacts the stopblock. Measure the distance from the end of the rabbet to the stopblock.



Now position a stopblock the measured distance from the bottom edge of the upper door rail (BB), and clamp it in place. Then start and stop routing the rabbet with the router base against the stopblock.

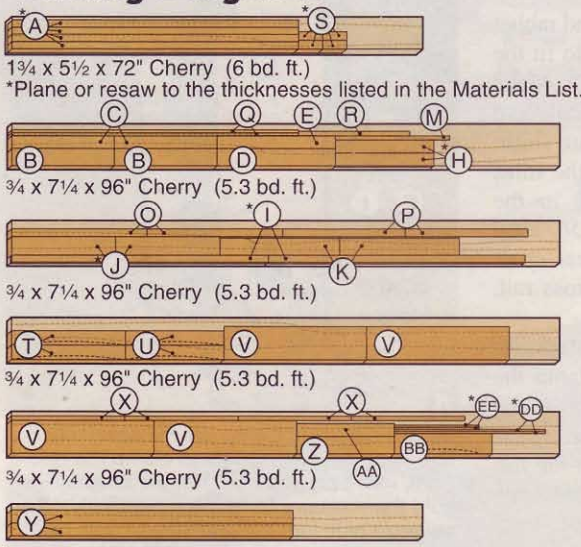
Materials List

Case	FINISHED SIZE T	W	L	Matl.	Qty.
A stiles	1¼"	1½"	50¼"	C	4
B lower side rails	¾"	3"	18"	C	2
C upper side rails	¾"	2¼"	18"	C	2
D lower back rail	¾"	3"	20¾"	C	1
E upper back rail	¾"	2¼"	20¾"	C	1
F side panels	¼"	18"	45¾"	CP	2
G back panel	¼"	20¾"	45¾"	CP	1
H trim rails	¼"	2¼"	17¼"	C	2
I* shelf pin holders	¼"	1¼"	45"	C	4
J cleats	½"	3¼"	18¼"	C	2
K cross rails	¾"	3"	21"	C	2
L fixed shelf panel	¾	17¾"	20"	CP	1
M fixed shelf band	¾"	¾"	20"	C	1
N bottom panel	¾"	18¼"	20½"	CP	1
O* front and back bands	¾"	1⅜"	23¼"	C	2
P* side bands	¾"	1⅜"	21"	C	2
Q stile fillers	½"	¾"	50¼"	C	2
R cross rail filler	¾"	¾"	19½"	C	1
Base, top, and shelves					
S feet	1¼"	1½"	4¼"	C	4
T front and back rails	¾"	2½"	20"	C	2
U side rails	¾"	2½"	17¼"	C	2
V* top	¾"	22¾"	25"	EC	1
W shelf panels	¾"	16⅜"	20⅜"	CP	4
X shelf bands	¾"	¾"	20⅜"	C	4
Door					
Y stiles	¾"	2¼"	49⅜"	C	2
Z lower rail	¾"	2 15/16"	17⅛"	C	1
AA middle rail	¾"	2¼"	17⅛"	C	1
BB upper rail	¾"	3½"	17⅛"	C	1
CC door panel	¼"	15⅝"	15 1/16"	CP	1
DD vertical stops	¼"	⅜"	26⅛"	C	2
EE horizontal stop	¼"	⅜"	14⅞"	C	1

*Parts initially cut oversize. See the instructions.

Materials key: C–cherry, CP–cherry plywood, EC–edge-joined cherry.

Cutting Diagram



and clamp the door, shown on **Drawing 11**, making sure it is square and flat.

5 To form the rabbet for the glass, lay the door outside face down on your workbench. For router-bit bearing clearance, insert ¾"-thick spacers under the stiles. Then clamp the door to the bench. Chuck a ⅜" rabbet bit in your handheld router, and measure the distance from the edge of the router base to the bit, as shown in **Photo E**. Now with the router bit pilot bearing riding on the *outside* lip of the ¼" groove in the stiles (Y) and middle rail (AA), rout away the *inside* lip, as shown in **Photo F**. Leave the radii at the tops of the stile rabbets, but square the bottom corners with a chisel.

Caution: *To avoid tear-out that could ruin the frame, clamp the door securely to your workbench, and make several shallow climb-cutting (counterclockwise) passes with your router. Then make a final clean-up (clockwise) pass.*

6 Resaw and plane the vertical glass stops (DD) and horizontal glass stop (EE) to size. Sand radii on the top ends of the vertical stops to match the rabbet ends. Then cut the horizontal stop to fit between the vertical stops. Clip the head off a #16 brad, and use it to drill pilot holes through the stop, where shown on **Drawing 11**.

7 Position non-mortise hinges where shown on **Drawing 11**, drill pilot holes, and screw the hinges to the door. Then hang the door in the case. Drill the knob hole, and attach the knob. Install the catches.

Supplies: #8×1¼" flathead wood screws, #8×1½" flathead wood screws, #8×1¼" roundhead wood screws, #8 flat washers, #10×⅝" panhead screws, #0 biscuits, #16×¾" brads, spray adhesive, single-strength glass.

Blades and bits: Stack dado set; 45° chamfer, ⅛" round-over, ⅜" rabbet, and thumbnail table-edge router bits; ¼" brad-point drill bit.

Sources

Hardware. Tabletop fasteners no. 13K01.01, $3.90 (package of 50); wrought-iron finish ball tip adjustable non-mortise partial wrap inset hinges with screws no. 01H31.52, $3.10 ea. (3); spring catches no. 00W11.02, $0.70 ea. (2); brass shelf supports no. 63Z06.04, $4.50 (package of 20); pewter-finish knob with 95mm escutcheon plate no. 01X30.33, $4.80 ea. (1). Call Lee Valley 800/871-8158, or go to leevalley.com.

Thumbnail bit. ½"-shank thumbnail table-edge bit no. 8560, $31. Call MLCS 800/533-9298, or go to mlcswoodworking.com.

Finish and assemble

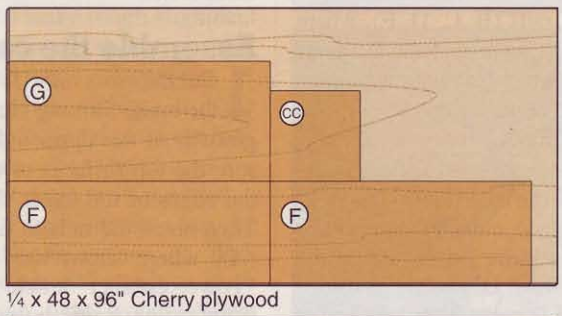
1 Remove the door and all hardware. Finish-sand the door, and touch up the finish-sanding elsewhere where needed.

2 Apply a clear finish. [We sprayed two coats of water-based satin polyurethane on the entire project, and a third coat on the top surface of the top (V), sanding with 220-grit sandpaper between coats.]

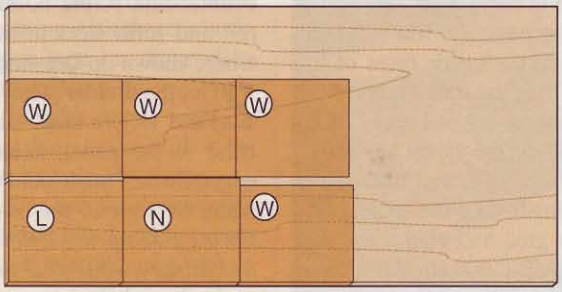
3 Place the top upside down on a pad, and center the case on it. Using the rear cross rail (K) holes as guides, drill pilot holes into the top, and drive the screws, where shown on **Drawing 7**. Then using the centers of the front cross rail slots as guides, drill pilot holes into the top, and fasten with washers and roundhead screws.

4 Center the base on the case bottom. Engage the tabletop fasteners in the grooves in the rails (T, U), where shown on **Drawing 7**. Using the holes in the fasteners as guides, drill pilot holes, and drive the screws. Turn the cabinet upright.

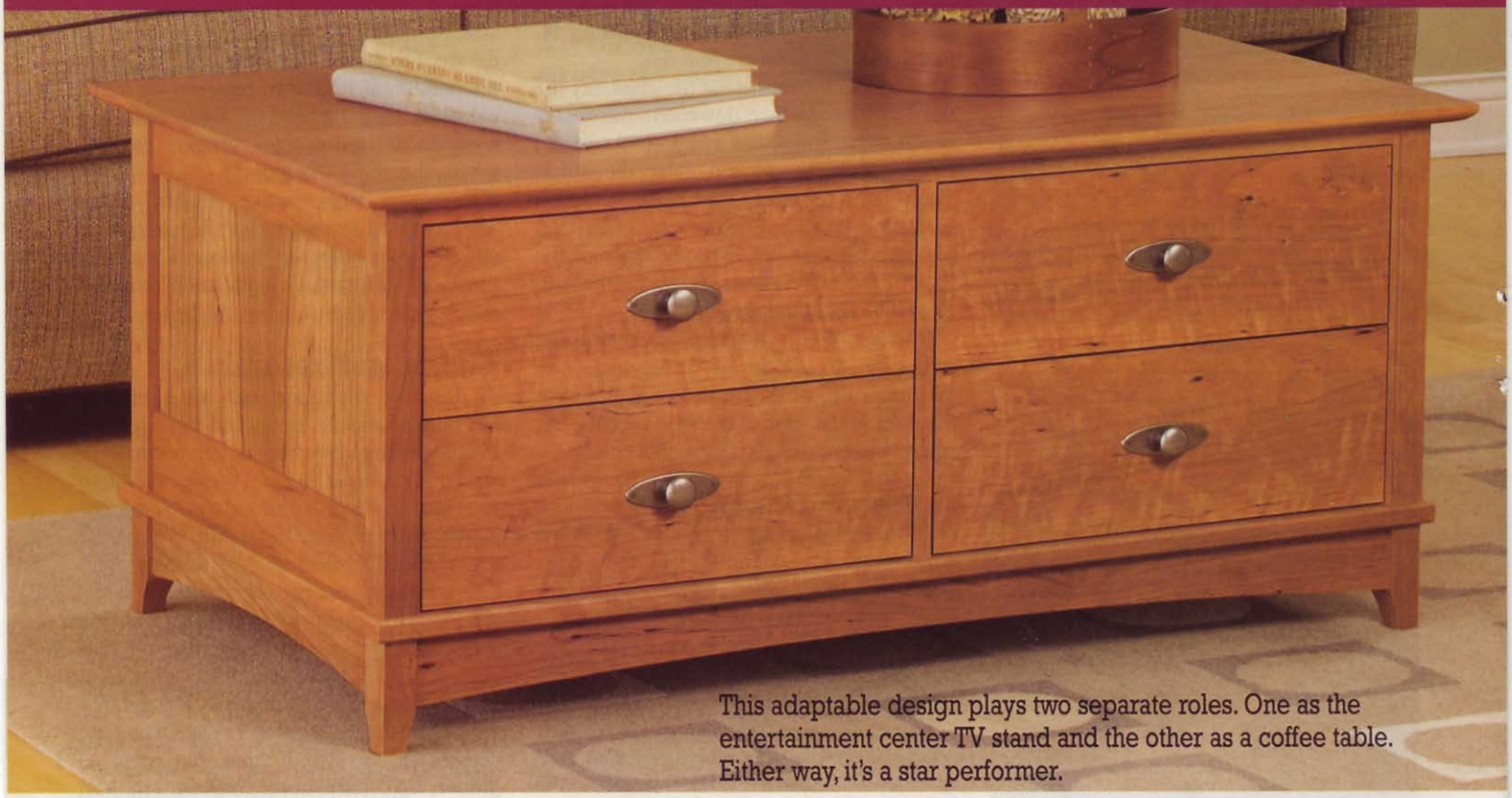
5 Install the glass in the door, sliding its top end into the top rail groove. Nail the stops in place, and fill the nail holes with a matching-color putty stick. Rehang the door, and reinstall the knob and catches. Install the shelf supports and shelves.



¼ x 48 x 96" Cherry plywood



¾ x 48 x 96" Cherry plywood



This adaptable design plays two separate roles. One as the entertainment center TV stand and the other as a coffee table. Either way, it's a star performer.

TV stand/coffee table

Start with the sides

1 From 1¾" stock (or laminated ¾"-thick stock), cut the stiles (A) to the size listed on the **Materials List**. Then cut the lower side rails (B), upper side rails (C), lower back rail (D), and upper back rail (E) to size.

2 Measure the actual thickness of the ¼" plywood for the panels (F, G), and cut grooves for the panels and rail stub tenons in the stiles (A) and rails (B, C, D, E), where shown on **Drawing 1**, *opposite*, and Drawings 2 and 3 in the "Tower Cabinet" article on *page 49*. (See the Shop Tip on *page 49* for information on different types of ¼" plywood.) Then cut ¾" grooves ¼" deep in the front stiles (A) for the stile fillers (O).

3 With a dado blade, cut stub tenons to fit in the grooves in the stiles (A) on the ends of the rails (B, C, D, E), where shown on **Drawing 1** and Drawing 3 in the "Tower Cabinet" article on *page 49*. Then cut ¼" grooves ¼" deep in the inside faces of the upper side rails (C) for the stub tenons of the cross rails (I). Now cut ¾" dadoes ¼" deep in the back rails (D, E) for the divider (J/K).

4 Cut the side panels (F) and back panel (G) to size. Finish-sand the stiles, rails, and panels. Then glue and clamp the two side assemblies (A/B/C/F), checking them for square.

5 Cut the cleats (H) to size, and rabbet the ends, where shown on **Drawing 1**. Position the lower cleats with the bottom edges and the bottom edges of the lower side rails (B) flush, and glue and clamp them to the stiles (A) and lower side rails. Position the upper cleats where dimensioned, and glue and clamp them to the stiles (A).

Assemble the case

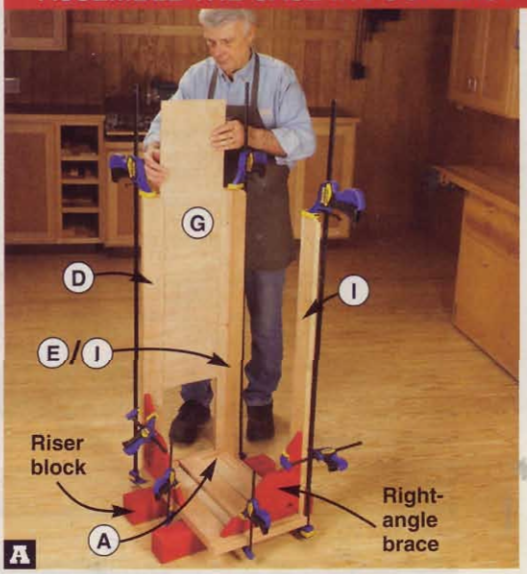
1 Cut the cross rails (I) to size, and rabbet the ends, forming stub tenons to fit the grooves in the upper side rails (C). Make sure the top surfaces of the cross rails and the edges of the upper side rails are flush. Then notch the rails to fit around the stiles (A), where shown on Drawing 6 in the "Tower Cabinet" article on *page 50*. Drill countersunk screw holes in the rear cross rail and form slots in the front cross rail, where shown on **Drawing 1**.

2 Cut the divider panel (J) and the divider band (K) to size. Glue and clamp the band to the panel, keeping the ends and edges flush. Finish-sand the divider.

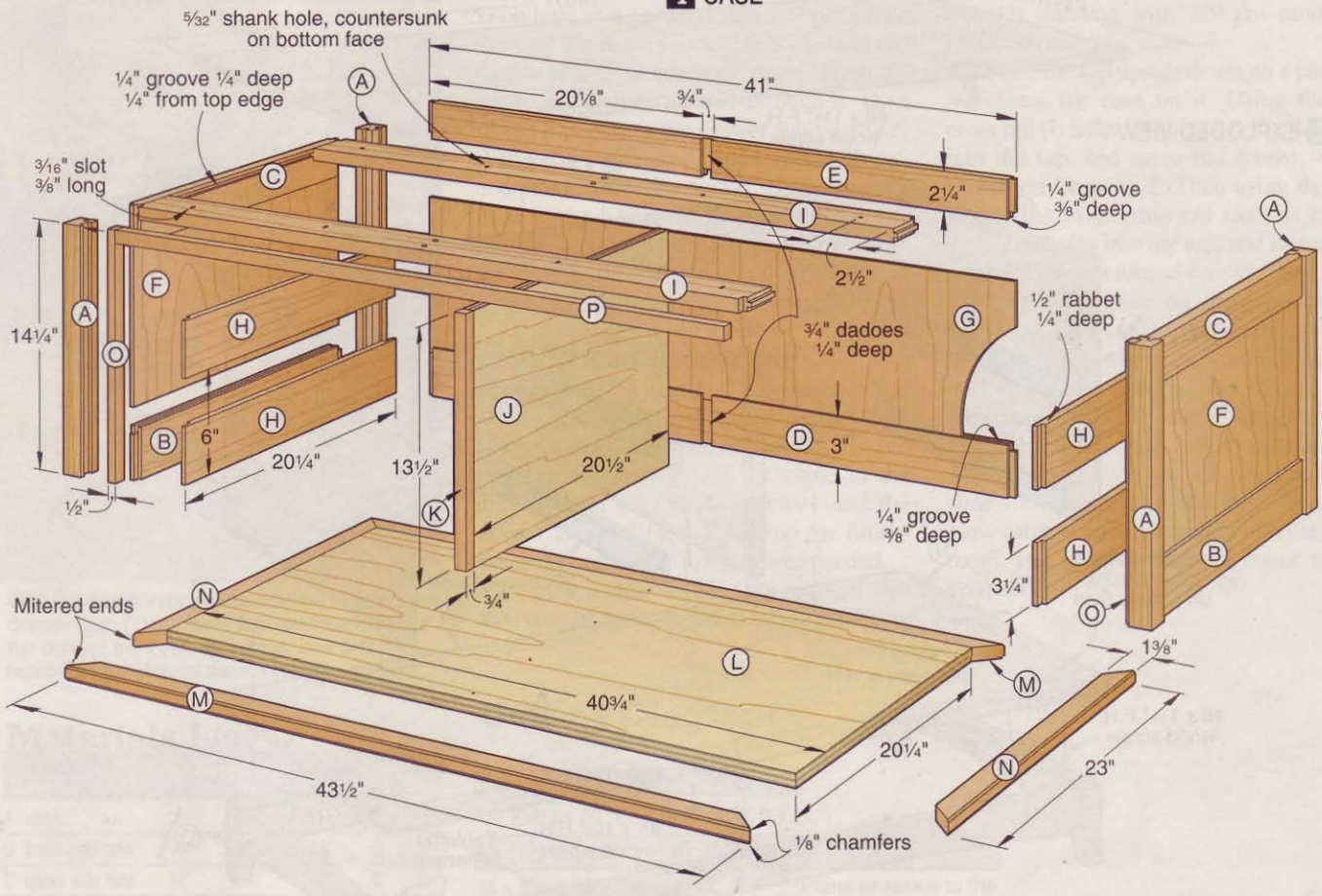
Note: *Because of the complexity of the following glue-up, use a slow-setting glue, such as ordinary white glue or Titebond Extend, and enlist a helper.*

3 Glue and clamp the rear cross rail (I) to the upper back rail (E), aligning the top surface of the cross rail with the top edge of the back rail and the cross rail end notches

ASSEMBLE THE CASE IN FOUR EASY



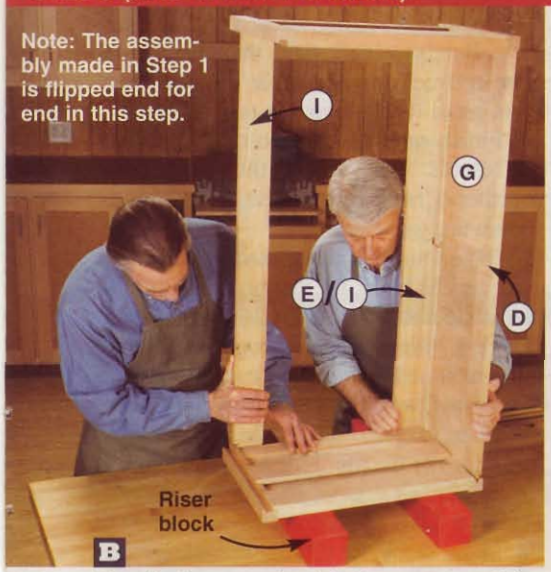
Step 1: Glue and clamp the rail assembly (E/I) in place. Then glue and clamp the rails (D, I), using plywood right-angle braces to hold them square to the side assembly. Now squeeze glue into the rear stile (A) groove, and slide in the back panel (G).



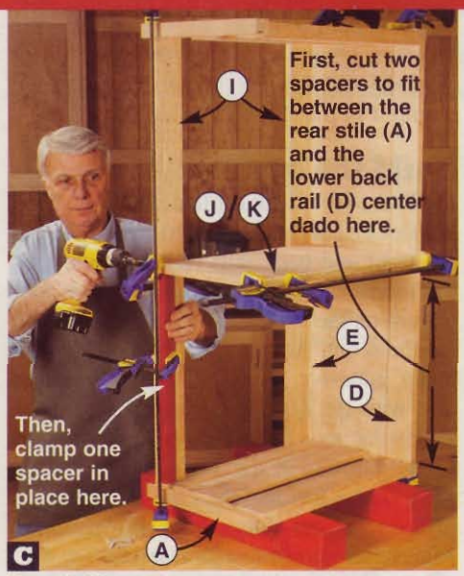
with the back rail tenon shoulders. Then lay one side assembly outside face down across a pair of riser blocks. (The riser blocks accommodate clamp heads during glue-up.) Now add the rail assembly (E/I), lower back rail (D), front cross rail (I), and back panel (G), as shown in **Photo A**. Check the side/back assembly for square, and let the glue dry.

4 Lay the other side assembly on the riser blocks. Then mate the side/back assembly with it, as shown in **Photo B**. Clamp the entire assembly, and check it for square.

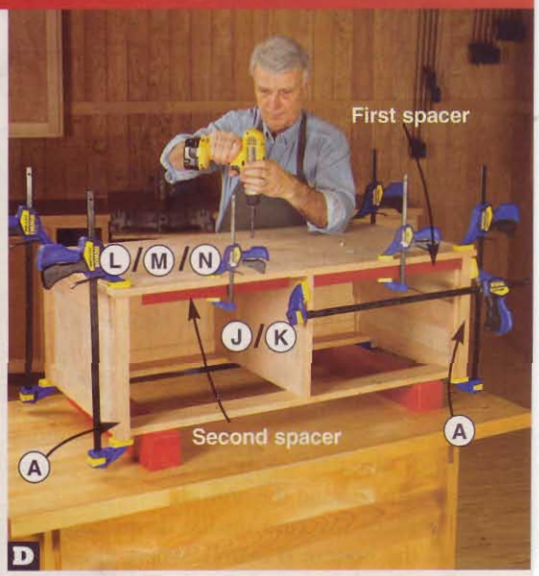
STEPS (AND WITH A HELPER)



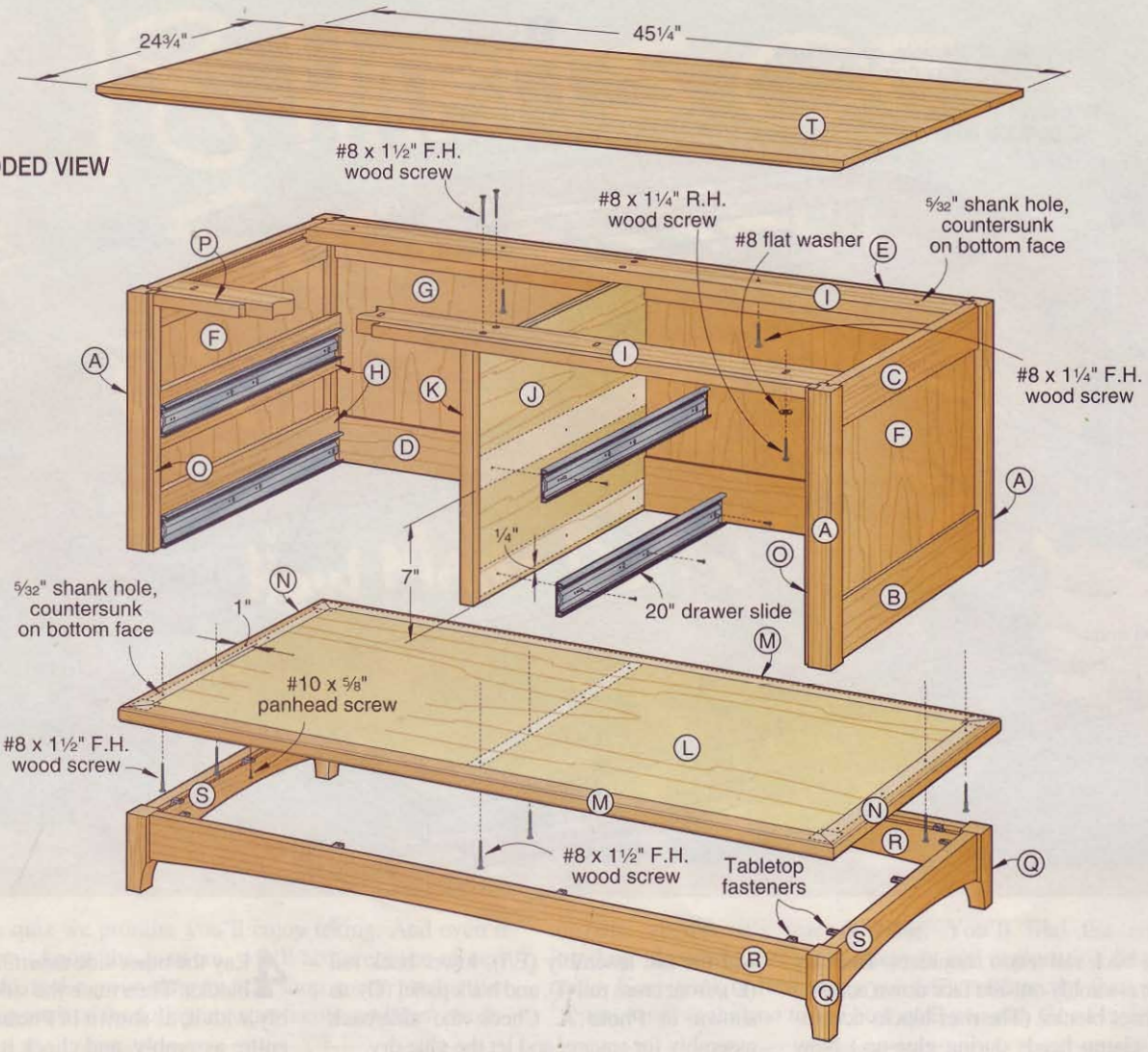
Step 2: Squeeze glue into the grooves of the second side. Then with a helper, pick up the side/back assembly and lower it into place. Starting at the back, seat the rail (D, E/I) stub tenons and back panel (G) into the second side grooves.


I
First, cut two spacers to fit between the rear stile (A) and the lower back rail (D) center dado here.
J / K
E
D
Then, clamp one spacer in place here.
A
C

Step 3: Measure and cut two spacers. Then clamp one to the cross rail (I), where shown. Glue and clamp the divider (J/K) into the back rail (D, E,) dadoes, resting its front edge on the spacer. Drill screw holes through the cross rails and into the divider.



Step 4: To keep the case sides parallel, clamp the two previously cut spacers between the divider (J/K) and the stiles (A), where shown. Center the bottom (L/M/N) on the case, and clamp it in place. Drill screw holes into the divider and lower rails.



5 Measure the distance between the rear stile (A) and the center dado in the lower back rail (D), and cut two scrap-wood spacers to this dimension. Then use one of the spacers to align the divider (J/K) for installation, as shown in **Photo C**. Drill countersunk screw holes through the cross rails (I) and into the divider, and drive the screws. Check the assembly for square, and let the glue dry.

6 Cut the bottom panel (L) to size. Then cut the front and back bands (M) and side bands (N) about ½" longer than listed. Now miter-cut the bands to fit, and glue and clamp them to the panel edges, where shown on **Drawing 1**. Sand the bottom flush. Rout ⅛" chamfers along the edges, and finish-sand the bottom.

7 Place the case upside down, and add the bottom (L/M/N), where shown on **Drawing 2** and as shown in **Photo D**. Drill countersunk screw holes through the bottom and into the lower side and lower back rails (B, D), and divider panel (L). Then drive the screws.

8 Cut the stile fillers (O) to size. Glue and clamp them in the front stile grooves, where shown on **Drawing 1**. Cut the cross rail filler (P) to size, and glue and clamp it in place. Finish-sand the fillers.

Build the base and top

1 From 1¾" stock (or laminated ¾"-thick stock), cut the feet (Q) to size. Then cut the front and back rails (R), and side rails (S) to size. Make two copies of each foot pattern on the *WOOD Patterns*® insert, and cut them out. Adhere them to the feet with spray adhesive, aligning the pattern fold line with the outside corner of each foot. Adjusting your biscuit joiner to center slots for #0 biscuits in the 1¼"- and 1½"-wide faces of the feet and then the ¾" thickness of the rails, cut slots where shown on the patterns and on **Drawings 3** and **3a**.

2 Bandsaw and sand the feet to the pattern lines. Then rout ⅛" round-overs along the bottom edges.

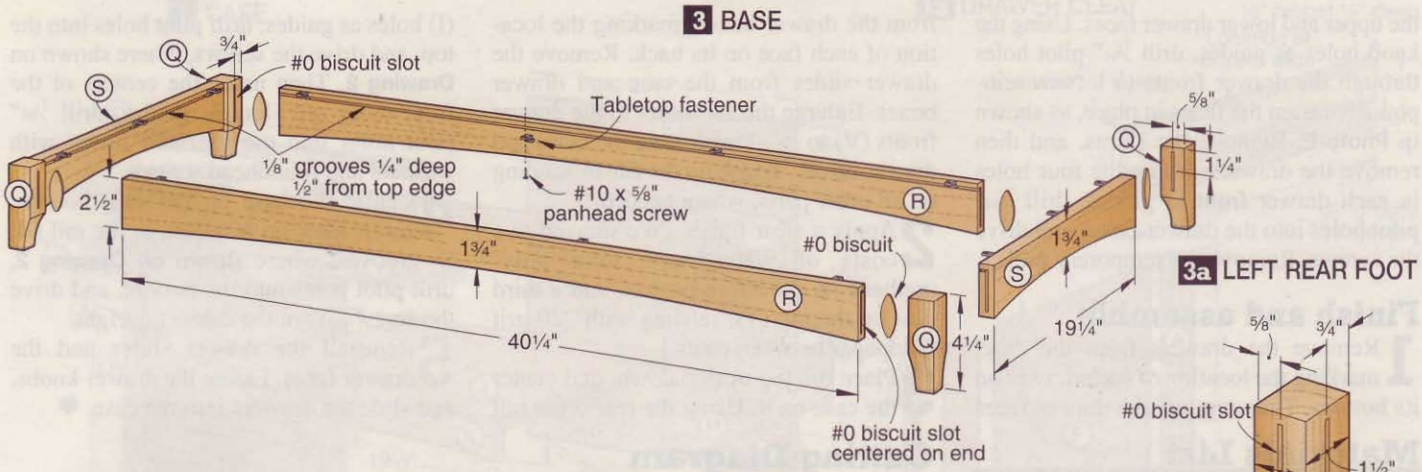
3 With your tablesaw, cut grooves for the tabletop fasteners in the rail (R, S) inside faces, where shown on **Drawing 3**. Then using a fairing stick, draw the rail arcs. Bandsaw and sand them to shape. (For a free downloadable fairing stick plan, go to woodmagazine.com/fairing.)

4 Finish-sand the feet and rails, and glue, biscuit, and clamp the base parts together. Check to make sure the base is square and sits flat.

5 Edge-join ¾"-thick boards to make an oversize blank for the top (T). Sand the blank smooth and cut it to finished size. Chuck a thumbnail table-edge bit in your table-mounted router, and rout the profile shown on Drawing 9 in the "Tower Cabinet" article on *page 51* along the bottom ends and edges of the top. Finish-sand the top.

Make the drawers

1 Plane stock to ½" thick, and cut the sides (U) and fronts and backs (V) to size. Following the two steps shown on **Drawing 4**, cut lock-rabbet joints, where shown on **Drawing 5**. Then measure the actual thickness of your ¼" plywood, and



cut 1/4"-deep grooves in the drawer fronts, backs, and sides for the bottoms (W). Now drill four shank holes in the fronts, countersunk on the inside faces.

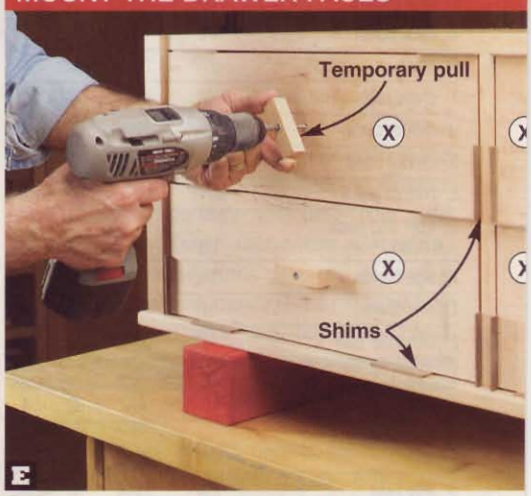
2 Cut the drawer bottoms (W) to size, and glue and clamp the drawer box parts together. Make certain the drawer boxes are square and flat.

3 Separate the drawer and case members of the drawer slides. Attach the drawer members to the sides (U), flush at the front and and centered 1" up from the bottom edge, where shown on **Drawing 5**. Then attach the case members to the cleats (H) and divider panel (J) flush with the front edges of the cleats and divider panel, where shown on **Drawing 2**. Slide the drawers into place.

***Note:** Do not use the 5/8"-long screws supplied with the drawer slides to fasten the drawer members to the 1/2"-thick drawer sides. Use 3/8"-long screws instead. When fastening the case members to both sides of the divider, stagger the screws.*

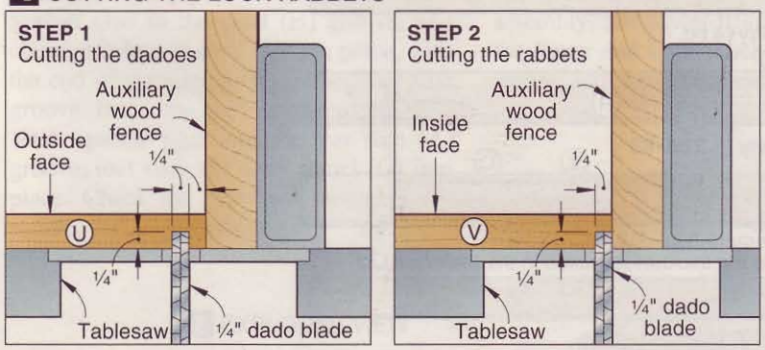
4 Cut the faces (X) to size, and drill a 3/16" knob hole in each one, where shown on **Drawing 5**. Then rip 5/64"-thick strips from the edge of 3/4"-thick scrap, and cut 20 shims 3" long. Position the four drawer faces, inserting shims between the case members and the drawer faces and between

MOUNT THE DRAWER FACES

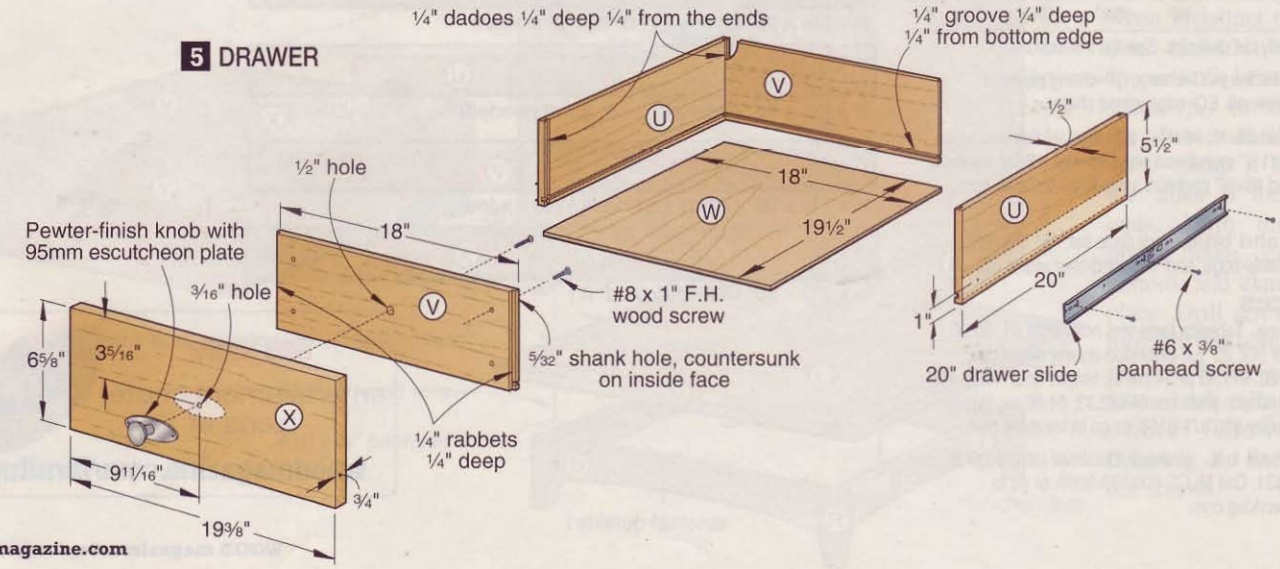


To hold the faces (X) in place, cut four temporary pulls from 3/4" scrap, and drill 3/16" holes through them. Then fasten these pulls to the drawers with #8×2" flathead wood screws.

4 CUTTING THE LOCK RABBETS



5 DRAWER



the upper and lower drawer faces. Using the knob holes as guides, drill 7/64" pilot holes through the drawer fronts (V). Now temporarily fasten the faces in place, as shown in **Photo E**. Remove the shims, and then remove the drawers. Using the four holes in each drawer front as guides, drill 7/64" pilot holes into the drawer faces, and drive the screws. Remove the temporary pulls.

Finish and assemble

1 Remove the drawers from the case, marking the location of each drawer on its bottom. Then remove the drawer faces from the drawer boxes, marking the location of each face on its back. Remove the drawer slides from the case and drawer boxes. Enlarge the 7/64" holes in the drawer fronts (V) to 1/2". Finish-sand the faces and drawer boxes. Touch up the finish-sanding on all other parts, where needed.

2 Apply a clear finish. [We sprayed two coats of water-based satin polyurethane on the entire project, and a third coat on the top (T), sanding with 220-grit sandpaper between coats.]

3 Place the top upside down, and center the case on it. Using the rear cross rail (I) holes as guides, drill pilot holes into the top, and drive the screws, where shown on **Drawing 2**. Then using the centers of the front cross rail slots as guides, drill 7/64" pilot holes into the top, and fasten with washers and roundhead screws.

4 Center the base on the case bottom. Insert tabletop fasteners in the rail (R, S) grooves, where shown on **Drawing 2**, drill pilot holes into the bottom, and drive the screws. Turn the cabinet upright.

5 Reinstall the drawer slides and the drawer faces. Fasten the drawer knobs, and slide the drawers into the case.

Materials List

	FINISHED SIZE T	W	L	Matl.	Qty.
Case					
A stiles	1¼"	1½"	14¼"	C	4
B lower side rails	¾"	3"	20"	C	2
C upper side rails	¾"	2¼"	20"	C	2
D lower back rail	¾"	3"	41"	C	1
E upper back rail	¾"	2¼"	41"	C	1
F side panels	¼"	20"	9¾"	CP	2
G back panel	¼"	41"	9¾"	CP	1
H cleats	½"	3¼"	20¼"	C	4
I cross rails	¾"	3"	41¼"	C	2
J divider panel	¾	13½"	20½"	BP	1
K divider band	¾"	¾"	13½"	C	1
L bottom panel	¾"	20¼"	40¾"	BP	1
M* front and back bands	¾"	1⅜"	43½"	C	2
N* side bands	¾"	1⅜"	23"	C	2
O stile fillers	½"	¾"	14¼"	C	2
P cross rail filler	¾"	¾"	39¾"	C	1
Base and top					
Q feet	1¼"	1½"	4¼"	C	4
R front and back rails	¾"	2½"	40¼"	C	2
S side rails	¾"	2½"	19¼"	C	2
T* top	¾"	24¾"	45¼"	EC	1
Drawers					
U sides	½"	5½"	20"	C	8
V fronts and backs	½"	5½"	18"	C	8
W bottoms	¼"	18"	19½"	CP	4
X faces	¾"	6⅝"	19⅜"	C	4

*Parts initially cut oversize. See the instructions.

Materials key: C–cherry, CP–cherry plywood, BP–birch plywood, EC–edge-joined cherry.

Supplies: #8×1", #8×1¼", and #8×1½" flathead wood screws; #8×1¼" roundhead wood screws; #8 flat washers; #10×⅝" and #6×⅜" panhead screws; #0 biscuits; spray adhesive.

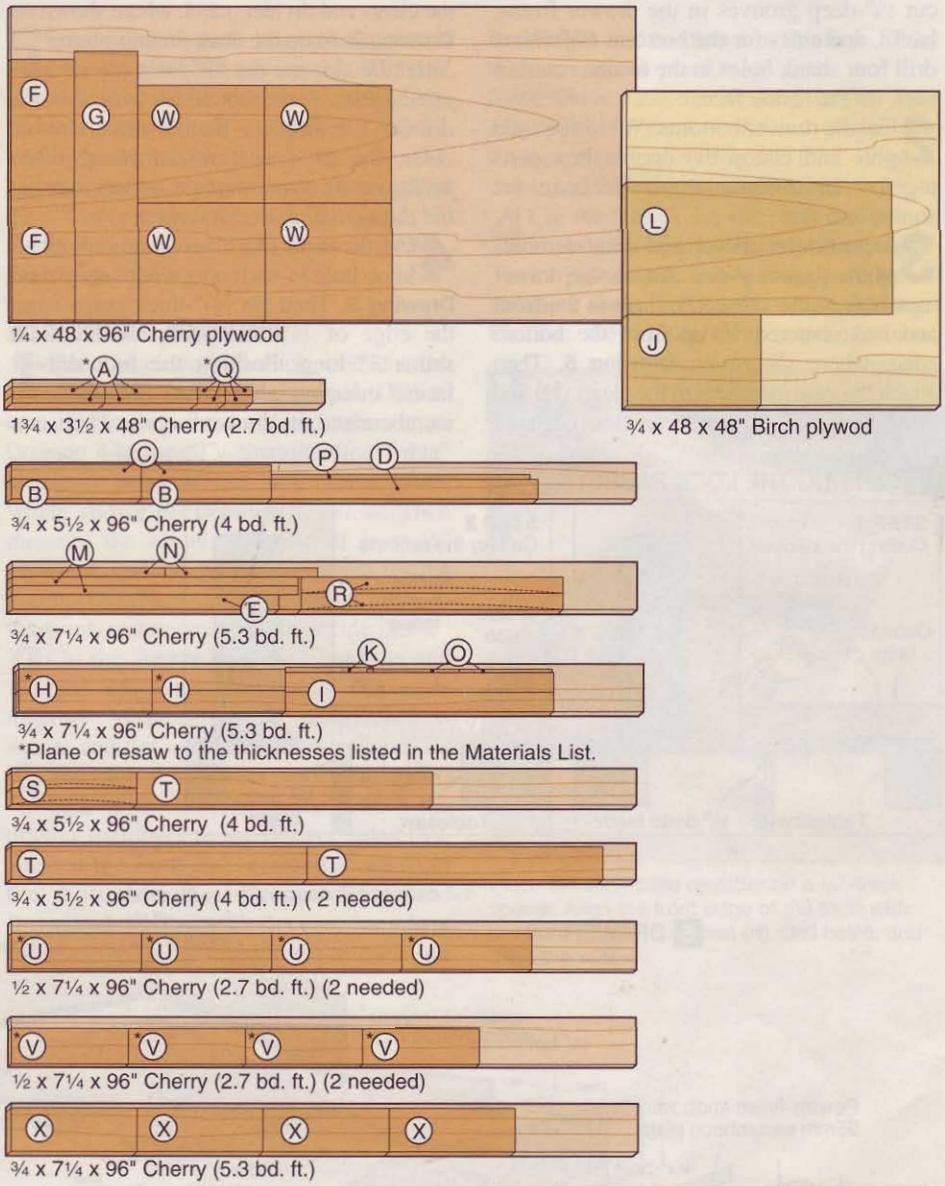
Blades and bits: Stack dado set; 45° chamfer, thumbnail table-edge, and ⅛" round-over router bits.

Sources

Hardware. Tabletop fasteners no. 13K01.01, $3.90 (package of 50); 20" full-extension drawer slides no. 02K30.20, $11.30 pr. (4 pairs); pewter-finish knob with 95mm escutcheon plate no. 01X30.33, $4.80 ea. (1). Call Lee Valley 800/871-8158, or go to leevalley.com.

Thumbnail bit. ½"-shank thumbnail table-edge bit no. 8560, $31. Call MLCS 800/533-9298, or go to mlcswoodworking.com.

Cutting Diagram



See more entertainment center plans at **woodmagazine.com/furniture**

end table

Build one or more of these end tables to accompany existing seating or to match the entertainment center on *page 46*. Either way, you'll have a great addition to any room.

Solid cherry and cherry veneers combine with traditional styling in this winning furniture design. Beneath its Shaker-style looks, biscuits and stub-tenon and groove construction make this table a builder-friendly project. Those making this project to match the entertainment center will note that the end table borrows its case construction from the tower cabinet and its drawer construction from the TV stand/coffee table. This lets you save time by combining machining operations.

Note: The **Materials List** *and* **Sources** *list parts to build one end table.*

Start with the sides

1 From 1¾" stock (or laminated ¾"-thick stock), cut the stiles (A) to the size listed on the **Materials List**. Then cut the lower side rails (B), upper side rails (C), lower back rail (D), and upper back rail (E) to size.

2 Measure the actual thickness of the ¼" plywood for the panels (F, G), and cut grooves for the panels and rail stub tenons in the stiles (A) and rails (B, C, D, E), where shown on **Drawing 1**, *opposite*, and Drawing 2 in the "Tower Cabinet" article on *page 48*. (See the Shop Tip on *page 49* for information on different types of ¼" plywood.) Then cut ¾" grooves ¼" deep in the front stiles (A) for the stile fillers (O, P).

3 With a dado blade, cut stub tenons to fit in the grooves in the stiles (A) on the ends of the rails (B, C, D, E), where shown on **Drawing 1** and Drawing 3 in the "Tower Cabinet" article on *page 49*. Then cut ¼" grooves ¼" deep in the inside faces of the upper side rails (C) for the stub tenons of the cross rails (I).

4 Cut the side panels (F) and back panel (G) to size. Finish-sand the stiles, rails, and panels. Then glue and clamp the two side assemblies (A/B/C/F), checking them for square.

5 Cut the cleats (H) to size, and rabbet the ends, where shown on **Drawing 1a**. Then cut ¾" grooves ¼" deep for the drawer shelf panel (J). Positioning the cleats where dimensioned, glue and clamp them to the stiles (A).

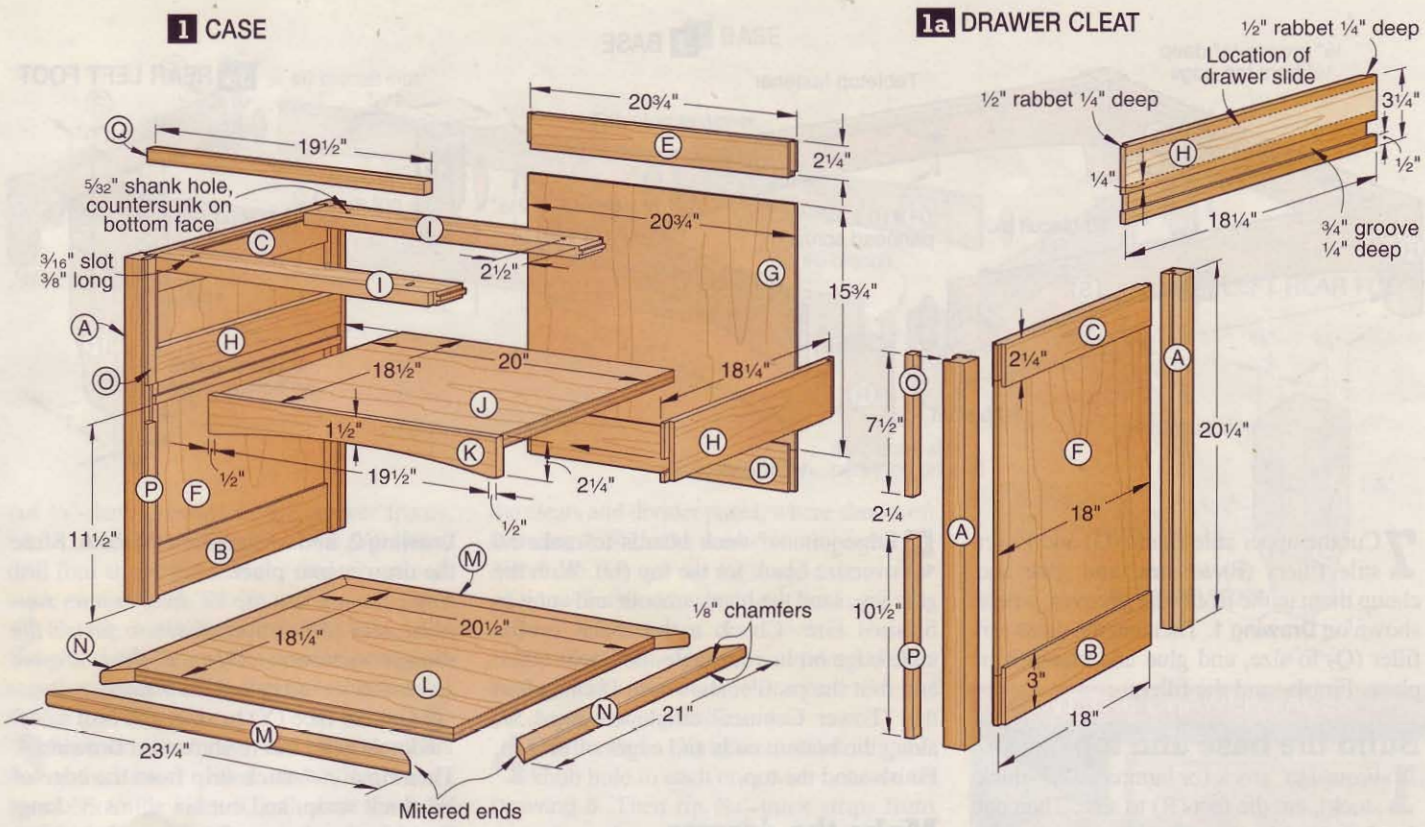
Assemble the case

1 Cut the cross rails (I) to size, and rabbet the ends, forming stub tenons to fit the grooves in the upper side rails (C). Make sure the top surfaces of the cross rails and the edges of the upper side rails are flush. Then notch the rails to fit around the stiles (A), where shown on Drawing 6 in the "Tower Cabinet" article on *page 50*. Drill countersunk screw holes in the rear cross rail and form slots in the front cross rail, where shown on **Drawing 1**.

2 Cut the drawer shelf panel (J) and the drawer shelf edging (K) to size. Lay out the middle and end points of the arc on the edging, where dimensioned on **Drawing 1**. Then using a fairing stick, draw the arc. (For a free downloadable fairing stick plan, go to woodmagazine.com/fairing.) Bandsaw and sand it to shape. Glue and clamp the edging to the panel, centered side-to-side and with its top edge flush with the top surface of the shelf panel. With the glue dry, finish-sand the shelf.

***Note:** Because of the time required for the following glue-up, use a slow-setting glue, such as ordinary white woodworking glue or Titebond Extend.*

3 Glue and clamp the rear cross rail (I) to the upper back rail (E), aligning the top surface of the cross rail with the top edge of the back rail and the cross rail end notches with the back rail tenon shoulders. Then lay one side assembly outside face down across a pair of riser blocks. (The riser blocks accommodate clamp heads during glue-up.) Now squeeze glue into the top of the rear stile (A) groove and the back of the upper side rail (C) groove, and clamp rail assembly (E/I) in place. Squeeze glue into

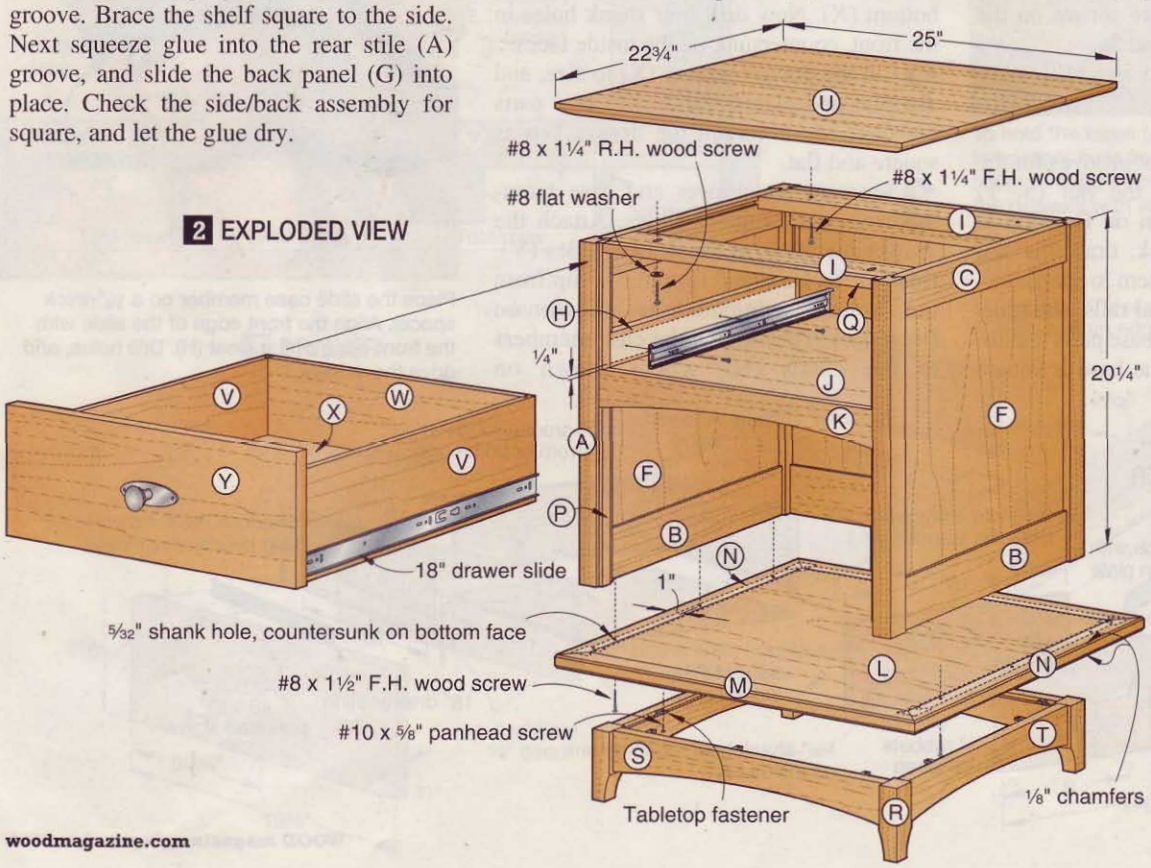


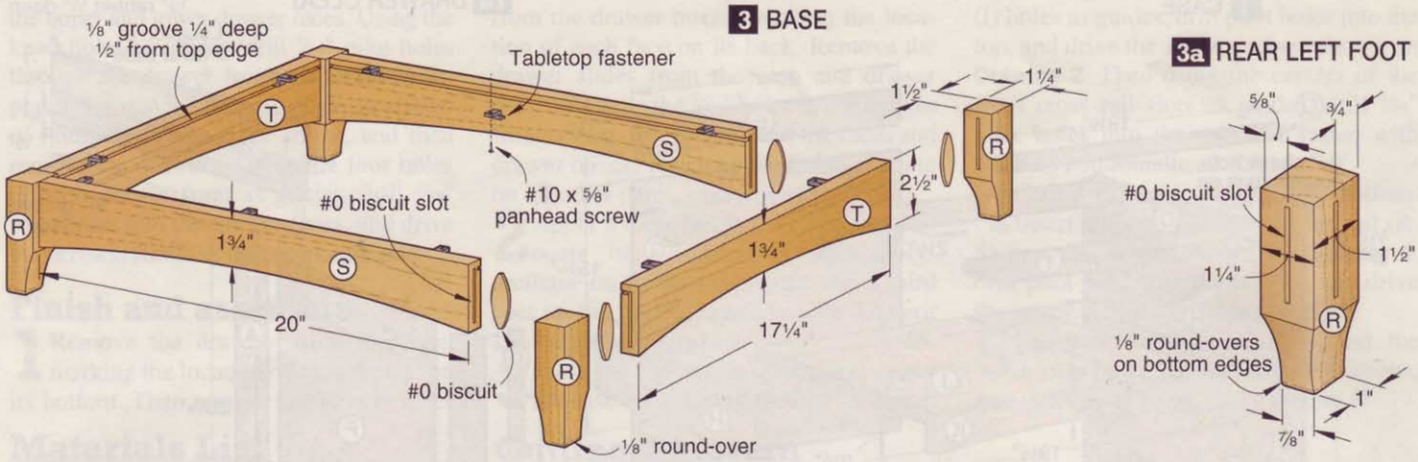
the bottom of the rear stile groove and the front of the upper side rail groove, and clamp the lower back rail (D) and front cross rail (I) in place, bracing them square to the side with plywood right-angle braces. Spread glue in the cleat (H) groove, and clamp the drawer shelf (J/K) in place, with the end of the edging (K) in the front stile groove. Brace the shelf square to the side. Next squeeze glue into the rear stile (A) groove, and slide the back panel (G) into place. Check the side/back assembly for square, and let the glue dry.

4 Lay the other side assembly outside face down across the riser blocks. Squeeze glue into the rear stile (A) groove, and the front and back of the upper side rail (C) groove. Now pick up the side/back assembly, and lower it into place. Engage the lower and upper back rail (D, E) stub tenons and the back panel (G) in the rear stile (A) groove, the cross rails (I) in the upper side rail (C) groove, and the drawer shelf (J/K) in the cleat (H) and front stile (A) grooves. Clamp the entire assembly, and check it for square.

5 Cut the bottom panel (L) to size. Then cut the front and back bands (M) and side bands (N) about ½" longer than listed. Now miter-cut the bands to fit, and glue and clamp them to the panel edges. Sand the bottom flush. Rout ⅛" chamfers along the edges, and finish-sand the bottom.

6 To make sure the sides are parallel when installing the bottom (L/M/N), cut a spacer to fit between the stiles (A) in front of the drawer shelf (J/K). Then clamp it between the stiles at the lower ends. With the case upside down, center the bottom, and clamp it in place. Drill screw holes through the bottom and into the lower side and lower back rails (B, D), where shown on **Drawing 2**, and drive the screws.





7 Cut the upper stile fillers (O) and lower stile fillers (P) to size, and glue and clamp them in the front stile grooves, where shown on **Drawing 1**. Then cut the cross rail filler (Q) to size, and glue and clamp it in place. Finish-sand the fillers.

Build the base and top

1 From 1¾" stock (or laminated ¾"-thick stock), cut the feet (R) to size. Then cut the front and back rails (S), and side rails (T) to size. Make two copies of each foot pattern on the *WOOD Patterns®* insert, and cut them out. Adhere them to the feet with spray adhesive, aligning the pattern fold line with the outside corner of each foot. Adjusting your biscuit joiner to center slots for #0 biscuits in the 1¼"- and 1½"-wide faces of the feet and then the ¾" thickness of the rails, cut slots where shown on the patterns and **Drawings 3** and **3a**.

2 Bandsaw and sand the feet to the pattern lines. Then rout ⅛" roundovers along the bottom edges.

3 With your tablesaw, cut grooves for the tabletop fasteners in the rail (S, T) inside faces, where shown on **Drawing 3**. Then using a fairing stick, draw the rail arcs. Bandsaw and sand them to shape.

4 Finish-sand the feet and rails, and glue, biscuit, and clamp the base parts together. Check to make sure the base is square and sits flat.

5 Edge-join ¾"-thick boards to make an oversize blank for the top (U). With the glue dry, sand the blank smooth and cut it to finished size. Chuck a thumbnail profile table-edge bit in your table-mounted router, and rout the profile, shown on Drawing 9 in the "Tower Cabinet" article on *page 51*, along the bottom ends and edges of the top. Finish-sand the top.

Make the drawer

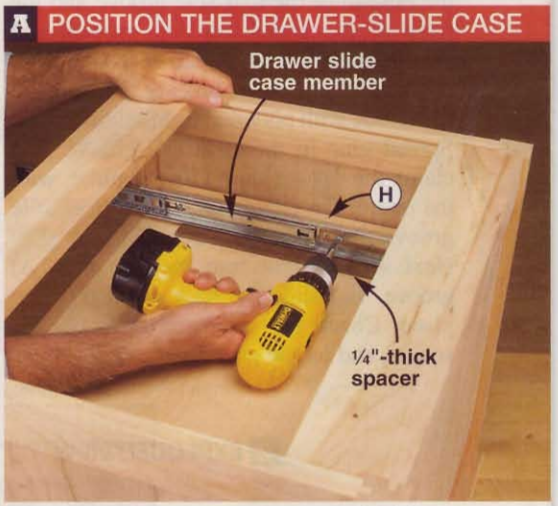
1 Plane stock to ½" thick, and cut the sides (V) and front and back (W) to size. Following the two steps shown on Drawing 4 in the "TV Stand/Coffee Table" article on *page 57*, cut lock rabbet joints, where shown on **Drawing 4**, *below*. Then measure the actual thickness of your ¼" plywood, and cut ¼"-deep grooves for the bottom (X). Now drill four shank holes in the front, countersunk on the inside faces.

2 Cut the drawer bottom (X) to size, and glue and clamp the drawer box parts together. Make certain the drawer box is square and flat.

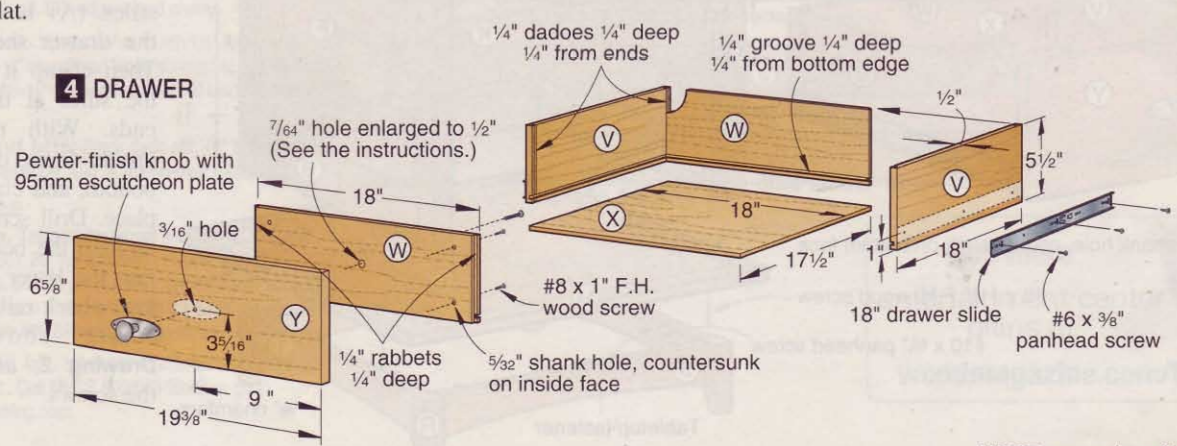
3 Separate the drawer and case members of the drawer slides. Attach the drawer members to the drawer sides (V), flush at the front and centered 1" up from the bottom edge, where shown on **Drawing 4**. Then attach the case members to the cleats (H), where shown on **Drawing 2**, and as shown in **Photo A**. Slide the drawer into place.

Note: *Do not use the ⅝"-long screws supplied with the drawer slides to fasten the drawer members to the ½"-thick drawer sides. Use ⅜"-long screws instead.*

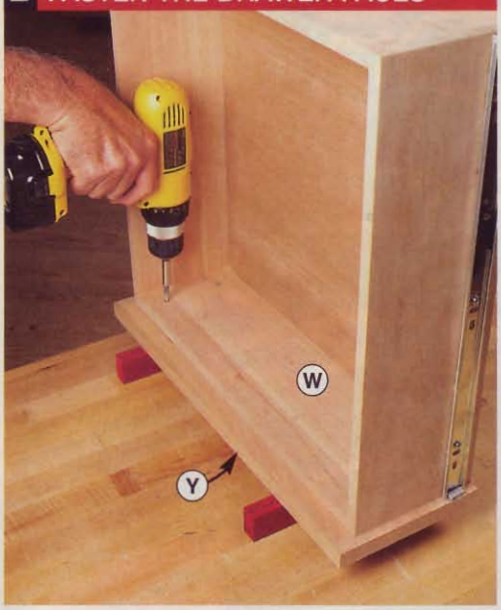
4 Cut the face (Y) to size, and drill a 3/16" knob hole, where shown on **Drawing 4**. Then rip a 1/16"-thick strip from the edge of ¾"-thick scrap, and cut six shims 3" long. Position the drawer face, inserting shims



Place the slide case member on a ¼"-thick spacer. Align the front edge of the slide with the front edge of the cleat (H). Drill holes, and drive the screws.



B FASTEN THE DRAWER FACES



With the temporary pull and screw holding the drawer face (Y) in place, use the four holes in the drawer front (W) as guides, and drill pilot holes into the drawer face. Drive the screws.

between it and the case members. Using the knob hole as a guide, drill a 7/64" pilot hole through the drawer front (W). To hold the face in place, cut a temporary pull from 3/4" scrap, and drill a 3/16" hole through it. Then fasten this pull to the drawer with a #8×2" flathead wood screw. Remove the shims, and then remove the drawer. Using the four holes in the drawer front as guides, drill 7/64" pilot holes into the drawer face, and fasten the face to the drawer front, as shown in **Photo B**. Remove the temporary pull.

Finish and assemble

1 Remove the drawer from the case and the drawer face from the drawer box. Remove the drawer slides from the case and drawer box. Enlarge the 7/64" hole in the drawer front (W) to 1/2". Finish-sand the drawer box and face. Touch up the finish-sanding on all other parts, where needed.

2 Apply a clear finish. [We sprayed two coats of water-based satin polyurethane on the entire project, and a third coat on the top (U), sanding with 220-grit sandpaper between coats.]

3 Place the top upside down on a pad, and center the case on it. Using the rear cross rail (I) holes as guides, drill pilot holes into the top, and drive the screws, where shown on **Drawing 2**. Then using the centers of the front cross rail slots as guides, drill pilot holes into the top, and fasten with washers and roundhead screws.

4 Center the base on the case bottom. Engage the tabletop fasteners in the rail (S, T) grooves, where shown on **Drawing 2**, drill pilot holes into the bottom, and drive the screws. Turn the cabinet upright.

5 Reinstall the drawer slides and the drawer face. Fasten the drawer knob, and slide the drawer into the case. That's it! Now carry your new creation into the living room, and give it a place of honor next to your sofa or favorite chair.

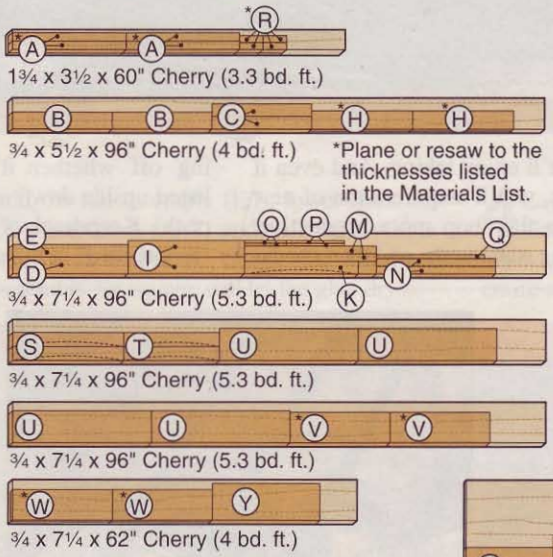
Materials List

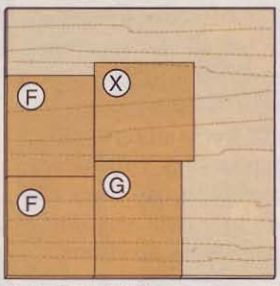
Case	FINISHED SIZE T	W	L	Matl.	Qty.
A stiles	1¼"	1½"	20¼"	C	4
B lower side rails	¾"	3"	18"	C	2
C upper side rails	¾"	2¼"	18"	C	2
D lower back rail	¾"	3"	20¾"	C	1
E upper back rail	¾"	2¼"	20¾"	C	1
F side panels	¼"	18"	15¾"	CP	2
G back panel	¼"	20¾"	15¾"	CP	1
H cleats	½"	3¼"	18¼"	C	2
I cross rails	¾"	3"	21"	C	2
J drawer shelf panel	¾	18½"	20"	CP	1
K drawer shelf edging	¾"	2¼"	20½"	C	1
L bottom panel	¾"	18¼"	20½"	CP	1
M* front and back bands	¾"	1⅜"	23¼"	C	2
N* side bands	¾"	1⅜"	21"	C	2
O upper stile fillers	½"	¾"	7½"	C	2
P lower stile fillers	½"	¾"	10½	C	2
Q cross rail filler	¾"	¾"	19½"	C	1
Base and top					
R feet	1¼"	1½"	4¼"	C	4
S front and back rails	¾"	2½"	20"	C	2
T side rails	¾"	2½"	17¼"	C	2
U* top	¾"	23¾"	25"	EC	1
Drawer					
V sides	½"	5½"	18"	C	2
W fronts and backs	½"	5½"	18"	C	2
X bottom	¼"	17½"	18"	CP	1
Y face	¾"	6⅝"	19⅜"	C	1

*Parts initially cut oversize. See the instructions.

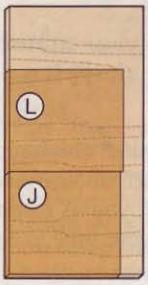
Materials key: C–cherry, CP–cherry plywood, EC–edge-joined cherry.

Cutting Diagram





¼ x 48 x 48" Cherry plywood



¾ x 48 x 24" Cherry plywood

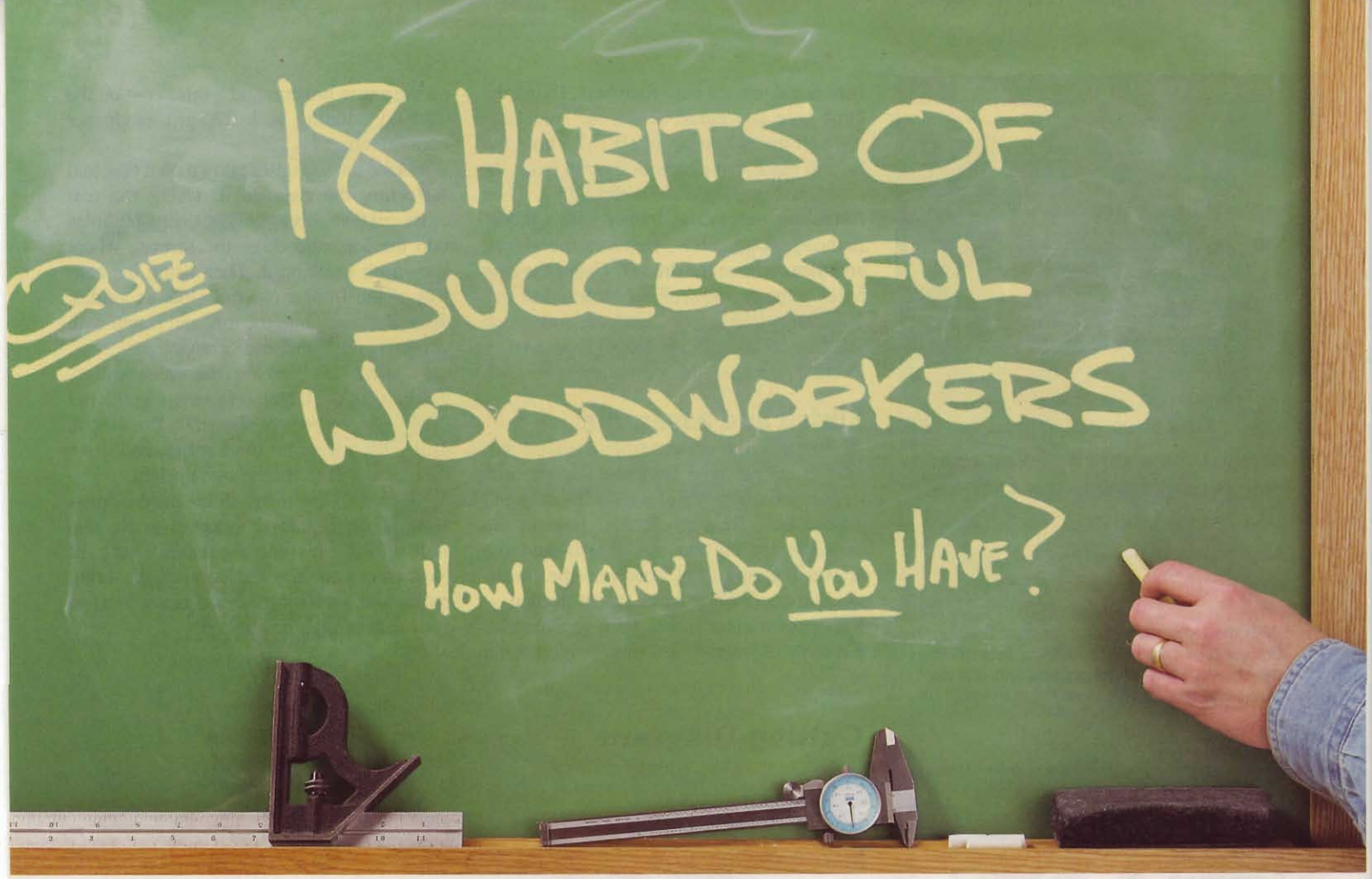
Supplies: #8×1", #8×1¼",and #8×1½" flathead wood screws; #8×1¼" roundhead wood screws; #8 flat washers; #10×⅜" and #6×⅜" panhead screws; #0 biscuits; spray adhesive.

Blades and bits: Stack dado set; 45° chamfer, ⅛" round-over, and thumbnail table-edge router bits.

Sources

Hardware. Tabletop fasteners no. 13K01.01, $3.90 (package of 50); 18" full-extension drawer slide no. 02K30.18, $10.60 pr. (1 pair); pewter-finish knob with 95mm escutcheon plate no. 01X30.33, $4.80 ea. (1). Call Lee Valley 800/871-8158, or go to leevalley.com.

Thumbnail bit. ½"-shank thumbnail table-edge bit no. 8560, $31. Call MLCS 800/533-9298, or go to mlcswoodworking.com.



Here's a quiz we promise you'll enjoy taking. And even if you don't know the answers, you'll acquire a ton of new skills to make your time in the shop more productive. Begin by reading each of the following statements, and then checking off whether it's true or false. You'll find the answers listed upside down after each statement and explanation (but don't peek). Keep track of how many you answer correctly, then use the "report card" at the end to see how well you did. Good luck!

1 A full set of plans gives you everything you need to successfully complete your project.

❑True ❑False

Even when working from a complete set of plans, keeping track of all the processes in a project can be difficult. This proves especially true if your shop sessions get interrupted by days or weeks of downtime. So, before every shop session, write down what you want to accomplish, and check off each item as you do to ensure you don't skip steps or needlessly duplicate efforts.

Answer: False

2 You should always take your materials list along when you go lumber shopping.

❑True ❑False

When selecting stock, keep in mind which project parts a board might yield and whether the grain and color will match surrounding pieces. Both of these tasks prove much simpler if you have the materials list with you. A cutting diagram helps as well. Most good lumber dealers won't rush you, so take your time to ensure you select the best stock available.

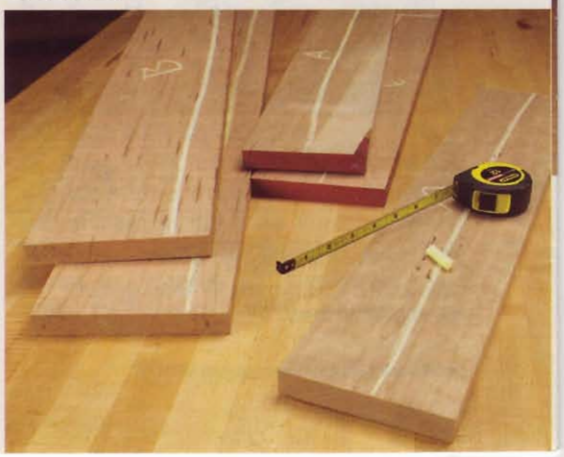
Answer: True

3 Lay out your project parts exactly as shown on the cutting diagram in the plan.

❑True ❑False

Use cutting diagrams to help decide how much stock to purchase, but not necessarily for locating parts on the boards you buy. Instead, lay out the largest and most visible parts first on the best areas from each board. Then, work through parts that are smaller and less visible. Doing this yields a better looking project and minimizes wood waste.

Answer: False

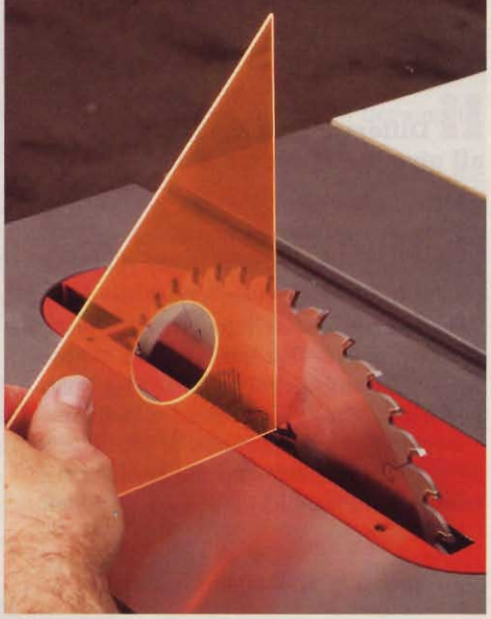


4 A properly adjusted tool will always give accurate results.

❑True ❑False

In the *WOOD*® magazine shop, where multiple people use the tools, a simple rule exists: Always return settings to "zero" when through using the tool. Even if nobody else touches your equipment, you should get in this habit too. Take a moment to recheck those settings before you use that tool again. This saves the frustration of, for example, ripping a board and then finding you had the tablesaw blade tilted 2° the last time you used it.

Answer: False



5 You can tell when a blade or bit is beginning to get dull.

❑True ❑False

Carbide cutters stay sharp for a long time, and powerful tool motors will hammer even dull ones through wood. This can make it difficult to tell just exactly when a cutter needs to be resharpened. Look for the following to identify dullness:

- Pitch buildup
- Excessive chip-out in cut stock
- Increased feed pressure
- Burning of cut surfaces (at the tablesaw, especially if it occurs on both sides of the blade)
- High motor loads indicated by louder-than-normal running noise or the tool slowing down as it cuts.

Answer: True

6 You can create accurate layout marks using pencils, pens, and chalk.

❑True ❑False

You can't get accurate results without precise layout. But you don't have to own expensive marking tools to get the job done.

You can make on-the-money layout marks using a combination square and a few common writing devices found in every shop:

- Use chalk to name parts and make rough alignment marks. It shows up well and wipes off easily.
- Mark surfaces using a sharp pencil to create fine, removable layout marks—just don't press too hard.
- Pencil marks can be difficult to see on dark woods and tough to erase from light woods. When working with those woods, place tape on the surface and write on it.
- Identify waste areas so you don't cut or drill on the wrong side of your line.
- Use arrows to designate outside faces and to distinguish mirror-image parts.

Answer: True

Arrowheads indicate exposed faces.
Mark areas that won't be seen with permanent marker.
Chalk wipes off easily.
Clear packing tape eliminates erasing and sanding, and provides space for making notes. Use a fine-tip permanent marker to make your marks.
Apply masking tape to dark woods in order to make layout marks stand out.
Waste area

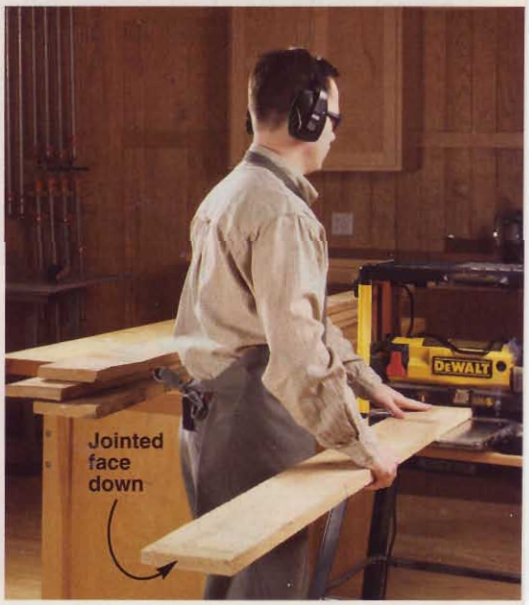
7 Whether bought at a home center or a sawmill, lumber can go straight to the saw as soon as you bring it home from your wood supplier.

❑True ❑False

Let any wood you buy—even if it's kiln dried—acclimate to the humidity in your shop for a few days before you work with it.

Whether you buy rough or surfaced stock, you'll have to true it up before cutting it into parts. Start by face-jointing any boards that need it, as shown, *below*, and then plane everything to thickness (shown at *bottom*). Even if you buy boards that are surfaced on all four sides (S4S), you may have to flatten one face at the jointer. At the least, plan to square up one edge and end before cutting surfaced stock.

Answer: False



8 You should precut all of the parts for your project.

❑True ❑False

We usually advise against precutting all of the parts to exact size at the beginning of a project. But you can cut them slightly oversize, and then mark each piece by letter or name. Always stack your parts neatly when you're not working with them. If you're concerned about parts getting misplaced or warped by moisture, bind them with clear plastic stretch wrap until you're ready for machining or assembly.

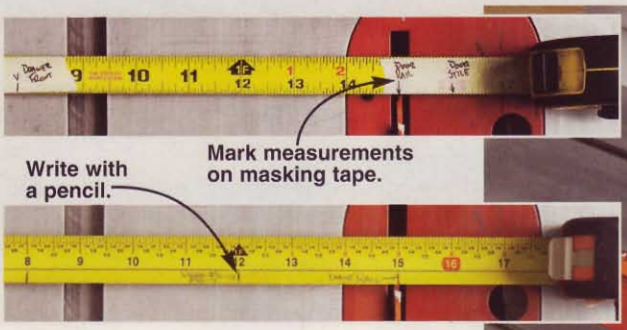
Answer: True

9 Accuracy requires measuring every part with a tape measure.

❑True ❑False

Every measurement introduces a chance for error. Prevent this by taking all of your measurements once (making sure they're accurate), and then transferring them to a story stick. Be sure to label each mark. Now you can set up your tools using the story stick instead of your tape measure.

Chuck Hedlund, *WOOD*® magazine's Master Craftsman, turns his tape measures into story sticks by applying masking tape to them and marking measurements on the tape. A company called FastCap uses this concept for its PS-SP tapes (about $7 for a 16' version). They feature a blank zone where you can make marks with a pencil. Visit fastcap.com, or call 888/443-3748.



Answer: False

10 Stopblocks ensure accuracy.

❑True ❑False

Stopblocks provide another great way to eliminate measurements. A block that rides completely against the table surface, though, can trap sawdust and chips that prevent workpieces from butting fully against the stop. Leave some space for these chips to escape.

Answer: False

11 Different tape measures will all give the same results.

❑True ❑False

Compare tape measures from several manufacturers and you'll likely find they read differently. Prevent errors by using just one tape measure throughout a project. Also make sure that the tape you choose reads the same as other measuring tools you'll use, such as a try square or steel rule.

Double-check the accuracy of your tape's 1" reading to make sure the hook hasn't become bent or stuck. If it has, start your measurements at the tape's 1" mark (often called burning an inch). Just be sure to add that 1" back on before you cut.

Answer: False

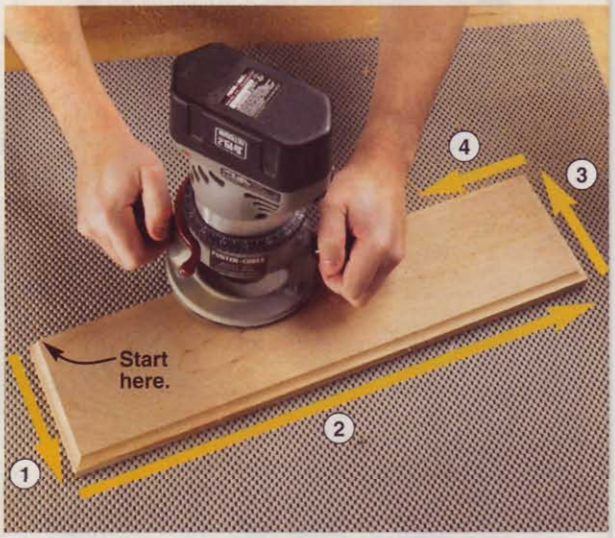
12 Chip-out in workpieces is inevitable.

❑True ❑False

You can eliminate chip-out by using sharp cutters and backer boards that support the wood where the cutter exits the workpiece.

If you can't use a backer, such as when routing a profile around the edges of a board, remember that chip-out occurs most often across the grain. For this reason, start on an end, and then work your way around counterclockwise. Any chip-out will get cut away as you rout the adjoining edge.

Answer: False



13 Woodworking glue gets old.

❑True ❑False

If you can't remember how long ago you bought the glue you're using, don't risk trashing a project because of failed joints. Woodworking glue has a shelf life that seldom exceeds a couple of years, so mark the purchase date on any bottle you buy, and either use it or pitch it before the glue passes its prime.

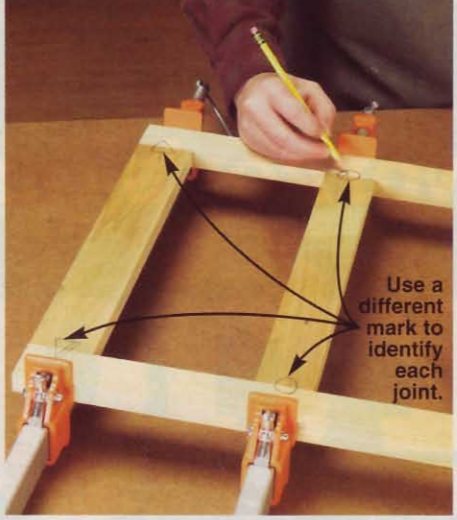
Answer: True

14 Gluing up parts is the first step in project assembly.

❑True ❑False

You have 18 project parts, 10 minutes of working time with the glue you just spread, and two hands. This is not the time to figure out how everything should go together, let alone whether it all fits. Assemble your project first without glue, though, and you can double-check joinery, head off alignment issues, and decide what assembly sequence works best.

Answer: False



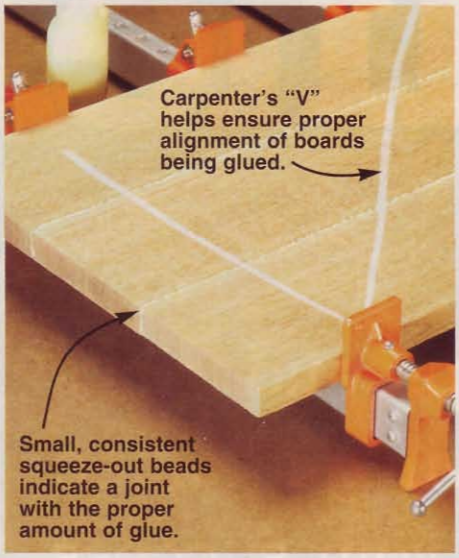
15 Glue squeeze-out needs to be avoided.

❑True ❑False

Nobody wants to clean up gobs of extra glue, so when joining parts, spread just a paper-thin layer of glue on each mating surface. This should put down the right amount of glue and help minimize slippage when you bring the parts together. Tighten the clamps until a consistent line of squeeze-out emerges, and you'll have a no-fail joint without mess.

If in doubt, though, too much glue presents the better option than too little. You'll have a mess to clean up, but you won't risk a glue-starved joint.

Answer: False


Carpenter's "V" helps ensure proper alignment of boards being glued.
Small, consistent squeeze-out beads indicate a joint with the proper amount of glue.

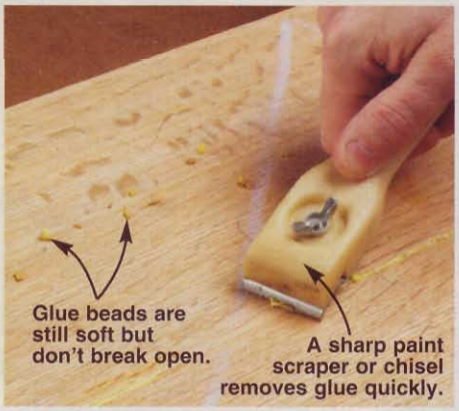
16 To clean up squeeze-out, immediately wipe it away with a damp cloth.

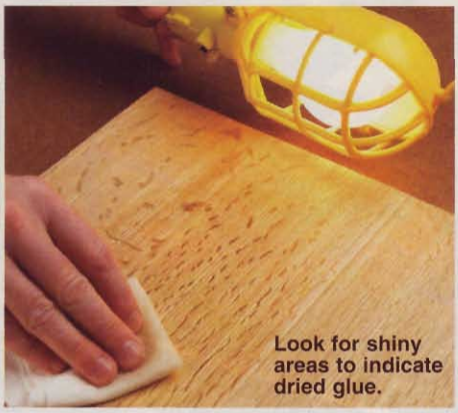
❑True ❑False

Some woodworkers wipe away squeeze-out while the glue is still wet. But this can raise grain, create a mess, and spread glue onto the surfaces surrounding the joint. Others advocate scraping away the glue after it dries. We prefer this method with polyurethane glue, but not with yellow or white glue. With those, wait until the beads skin over and become rubbery. Then use a sharp paint scraper or a chisel to scrape the glue away. Now wipe the surface lightly with a damp rag, being careful not to spread the glue.

After the glue dries, search out any glue you might have missed. Wipe surfaces with lacquer thinner, and hold a bright light at a low angle to the surface to highlight the glue.

Answer: False





17 You don't need defined dimensions for every project part.

❑True ❑False

Some parts in every project, such as door panels or drawer fronts, need to fit between other parts. Rather than cut those to the dimensions called for by the plans, simply measure between those points, allow for clearance, and you'll know the part will fit.

Answer: True

18 Labels on stain cans and in-store sample boards show the stain's true color.

❑True ❑False

Don't assume that the color shown on a label will truly represent how the stain will look on your project. To get an accurate indication of color, sand some of your leftover stock to the same grit as your finished project, and then stain portions to see what you'll really get. If you can't find what you're after, create your own shade by mixing two or more together, recording the amounts of each. Always stir stain well before you use it to ensure even coloring.

Answer: False

REPORT CARD

Check your score to determine whether you have great woodworking habits or whether you're due for more shop time.

★ **14 or more:** You're on target to graduate at the top of your woodworking class.

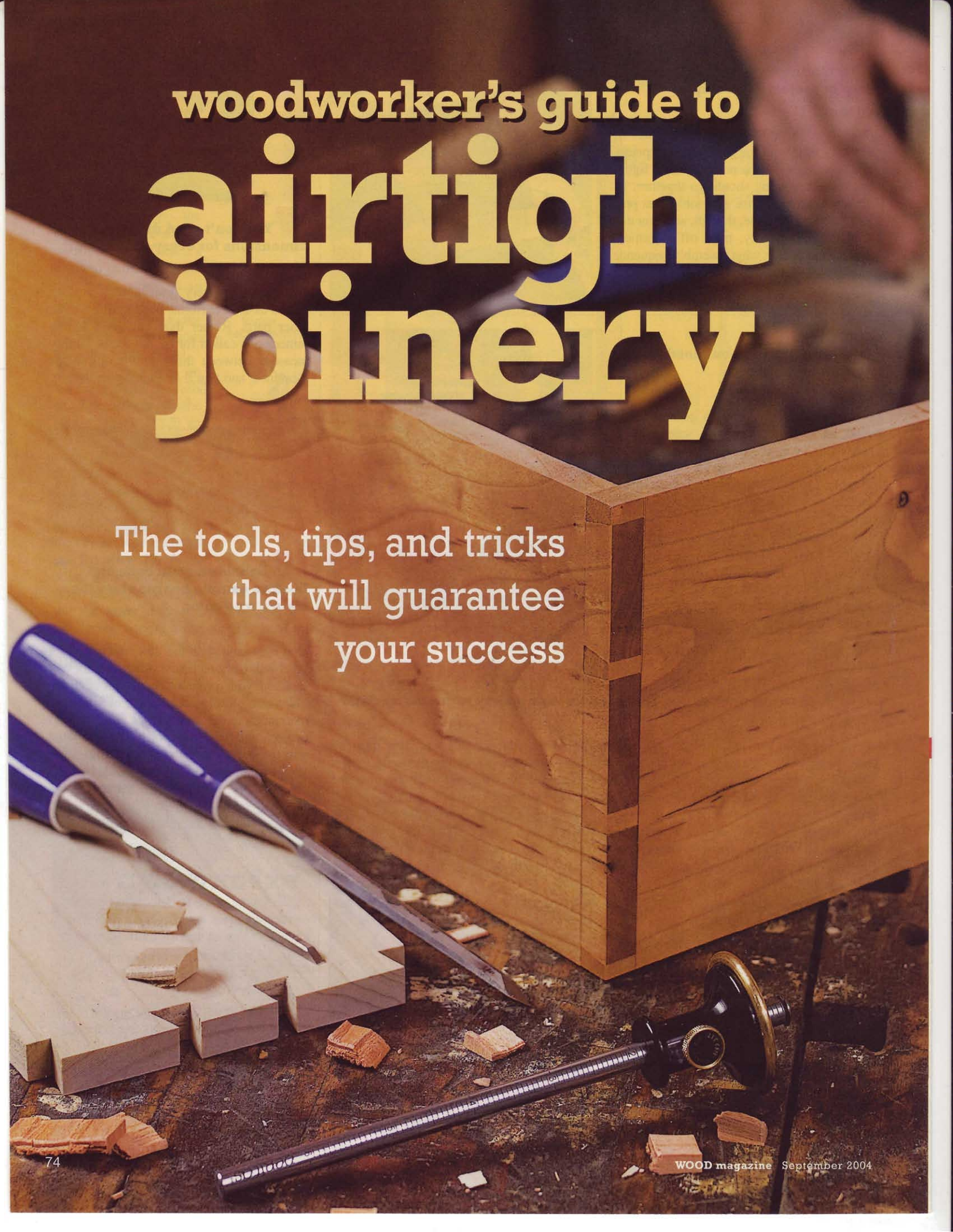
★ **8 to14:** You need further study to prevent errors that waste time and wood.

✓ **7 or less:** You definitely need to brush up on your skills. Don't get discouraged—you get to spend your detention time in the shop!

Written by **David Stone**

woodworker's guide to airtight joinery

The tools, tips, and tricks that will guarantee your success



Step 1: Lay out like a pro using on-the-money tools

Tight joints start with accurate layout. This is especially important when you cut joints with hand tools because the layout lines serve as reference points for your tools. With machine-cut joints, accuracy depends on setting fences, stops, blades, and bits with precision.

The photos *below* describe steps that help you achieve great layout results. You don't need fancy equipment, but look for tools with design features that ensure your accuracy and efficiency. For more about your choices, see the sidebar *below right*.

In addition, make these measurement guidelines part of your workshop habits:

- **Choose reliable tools.** For example, use a solid steel rule instead of a flexible tape measure whenever possible. Quality tools cost more, but they last a lifetime.
- **Be consistent.** Use the same measuring tools throughout a project to avoid slight discrepancies that might affect the fit of joints. For example, one rule might give a slightly different dimension for 10" than another rule.
- **Build on results.** Skip measuring altogether when you can use one part of a joint to mark its mating part. For example, cut the pins of a dovetail joint, and use them to mark the tail locations on the mating part.

MATCH THE RIGHT TOOLS WITH THE RIGHT TECHNIQUES

It's tricky to align the end of a rule precisely with the end of your stock, so "burn an inch" in that situation. Line up the 1" mark with the end and measure accordingly.

A sharp knife produces the finest possible layout line, which translates into high precision. In some cases, the incised line also provides a registration point for a chisel.

Use a marking gauge to strike a fine line parallel to the workpiece edge. Here we're marking the mortise location for a rail after drawing the rail end location.

MUST-HAVE LAYOUT TOOLS

We looked for precision tools that make it easier to achieve accurate layout and found these in the Lee Valley & Veritas catalog. Call 800/871-8158 or visit leevalley.com to order.

Here are the item numbers and prices of the tools you see on this page: calipers, 88N72.10, $27.50; 8" engineer's square, 24N07.08, $16.50; marking knife, 05U07.01, $19.95; 6" steel rule, 60N47.01, $4.95; combination square, 30N03.01, $62.50; wheel marking gauge, 05N33.10, $28.50.

When you need to check the thickness of a workpiece or the width of a dado set, calipers eliminate confusion by giving you a choice of readings: inches in decimals or fractions.

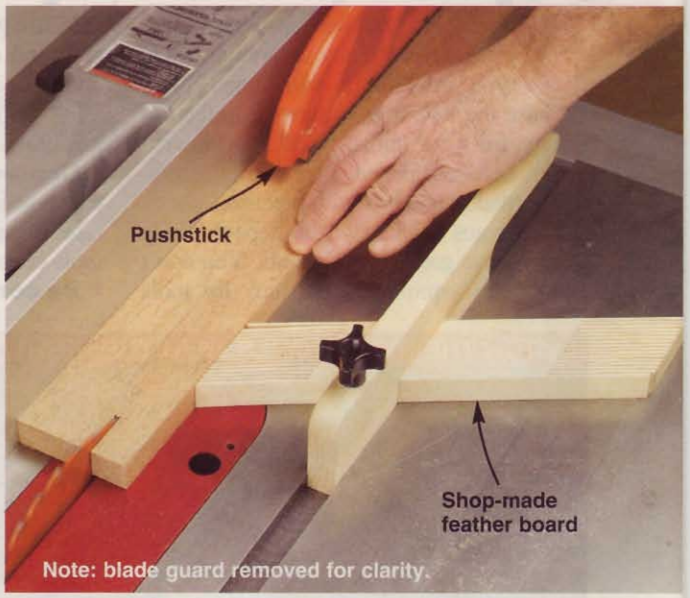
Make sure a machine fence is aligned at 90° to its table by checking with an engineer's square such as this 8" steel model.

Step 2: Set up your machines for precise cuts

A power tool provides top-notch results only when you set it up properly. Start with the basics shown on this page for three shop mainstays: Tablesaw, jointer, and table-mounted router. Once your machinery is ready, keep these rules of thumb in mind:

- **Assure uniform thickness.** Begin every project by dimensioning all of your stock to equal thickness. Any variation makes accurate joinery difficult and could result in additional sanding and scraping.
- **Emphasize convenience.** Long boards can be awkward to cut on a tablesaw or bandsaw; rough-cut slightly oversize workpieces that are easier to handle and cut accurately.
- **Double-check dimensions.** Sheet goods come in a range of thicknesses, so use your calipers to measure them. Then cut any needed dadoes and rabbets to suit.

Tablesaw: Before you do anything, align the miter-gauge slots parallel to the blade, set the miter gauge at 90° to the blade, and then align the fence with the miter-gauge slots. See issue 152, page 54, for details on accomplishing these steps or visit woodmagazine.com/tablesawtuneup for a copy of the article. When rip-cutting, use a feather board to keep the workpiece against the fence; to build the one shown here, see *page 40*. To build more accuracy-enhancing jigs, including a crosscut sled, see issue 151, page 80.



Jointer: Align the outfeed table flush with the top of the knives' cutting arc, as shown in the drawing at *right*. Then use a dead-on square to ensure that the fence is 90° to the outfeed table, as shown in the photo at *far right*. When using the jointer, guarantee smooth, accurate results by pressing the workpiece against the fence. Feed the stock slowly into the cutterhead knives. After the leading end passes over the cutterhead, shift downward pressure on the stock to the outfeed table.

FOR GREAT CUTS, ADJUST THE OUTFEED TABLE AND FENCE

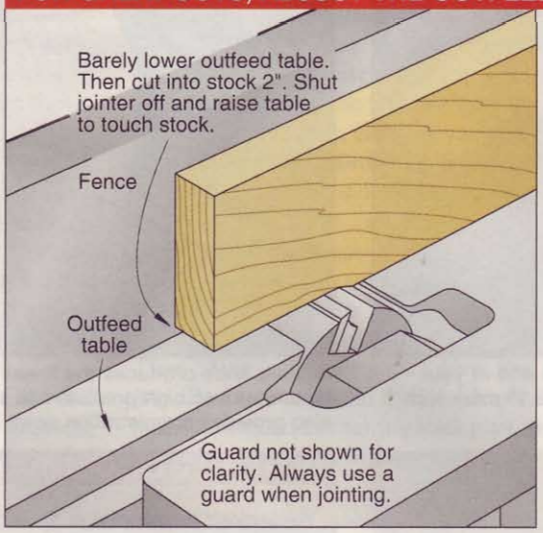
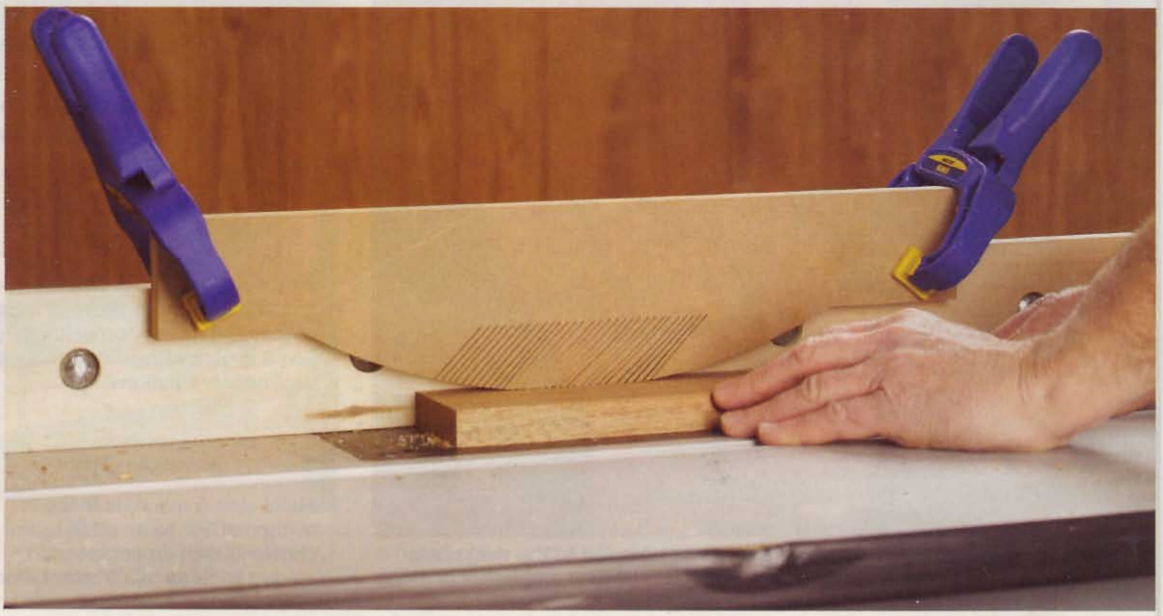

Barely lower outfeed table. Then cut into stock 2". Shut jointer off and raise table to touch stock.
Fence
Outfeed table
Guard not shown for clarity. Always use a guard when jointing.

Table-mounted router: Plan to make several passes for most routing operations, and set a stop for the final height for the last pass. Lock the router position each time after setting the bit height. When routing rabbets, slots for tongue-and-groove joints, and other joinery details, keep the workpiece flat with a hold-down, such as the feather board shown here. It's a simple jig to build and requires little material, as you can see in the photo at *right*.



Step 3: Fine-tune the results

Whether machine-cutting a single joint or several identical ones, make test cuts in scrap after setting up. Adjust the machine until the test joint fits snugly together, and then cut the mating project pieces.

In spite of your best efforts, you might find an imperfection. Sawdust on a machine table or undetected warpage in previously milled stock can be enough to throw off your cut and spoil the fit of the joint.

For undersize parts, see "Explore 4 levels of joint repair" on the following page. If a part is too wide or thick, resist the urge to machine it. The hand tools discussed here do a better job of making subtle adjustments.

- **Rabbet block plane:** This ranks as the fastest way to remove significant amounts of material—1/32" or more—from a wide tenon. A rabbet block plane, such as the one shown at *left*, features a low-angle blade for maximum effectiveness in shearing across the grain of a tenon. The blade's cutting edge extends to the sides of the plane body, allowing you to shave off wood right up to the tenon shoulder.

- **Rasp or file:** A flat rasp, as shown *below left*, features coarse teeth that remove stock quickly, but it leaves a rougher surface than does a plane. Flat files cut much more slowly, but work well for smoothing.
- **Sandpaper:** When you need to remove only a slight amount of material from a tenon or other wide surface, stick a piece of 100-grit sandpaper on an appropriately sized cork or wood block. Use self-adhesive sandpaper, or attach regular sandpaper to a block with spray adhesive or double-faced tape. By using this method instead of wrapping a block with sandpaper, you're able to sand the flat surface without altering adjacent vertical surfaces.
- **Chisel:** An assortment of chisel widths allows you to reach into any spot and remove wood from a specific area, as shown *below right*. Use the chisel with its beveled face up when paring wood from a flat surface; keep the flat face in contact with the wood for consistent results.

SHAPE JOINT SURFACES WITH A LIGHT TOUCH

Whether using a rasp, as shown in the left photo; a chisel, right; or another tool to remove material, work patiently and test the fit of the joint frequently.

Step 4: Carefully plan your assembly sequence

You've accurately sized all of your pieces and cut snug-fitting joints, so now you're ready to put your project together. But before you grab the glue, always do a complete dry (without glue) assembly. As you put the dry parts together, figure out the best order of assembly, how many clamps you need to press all of the joints together without gaps, and where to place the clamps to hold the joints without distorting them.

Plan to assemble a large project in a series of subassemblies instead of scrambling to fit everything together at the same time. For example, if you're assembling a cabinet with frame-and-panel ends, build the end panels first as shown in the photo at *right*, then proceed to the overall assembly. This method gives you more time to check the fit of each joint and fewer clamps to handle.

Another way to buy time: Use glue designed to dry slowly and provide longer open time. For example, Titebond's standard yellow glue has an open time of about 15 minutes but its Extend version gives you up to 25 minutes to make adjustments.

As you clamp, make sure to align the pressure points of the clamp with the center of the joint. A misaligned clamp might twist the joint enough to create a gap.

A joint that's snug during dry assembly might turn stubborn after absorbing moisture from glue. Coax it into place with a dead-blow mallet. Hold scrap on the joint to receive the blow.

Let the glue dry until its surface turns rubbery and then slice it off with a scraper or chisel. Left to harden, the glue might pull out wood fibers when you scrape it off, creating easy-to-detect voids.

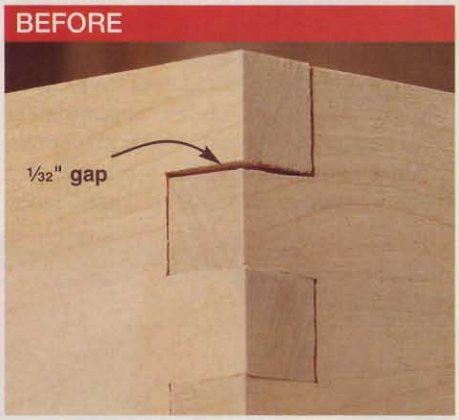
TAKE ONE SMALL ASSEMBLY STEP AT A TIME

Build a cabinet in subassemblies—such as this small end panel—so that you have time to pay attention to each joint. Then proceed with the overall assembly.

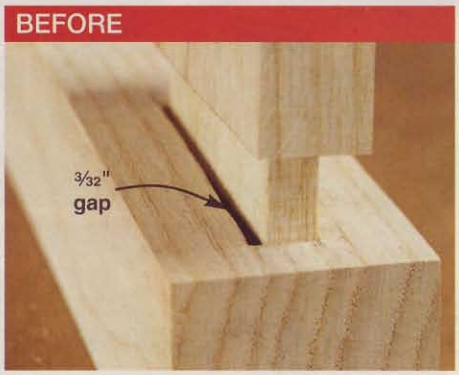
Explore 4 levels of joint repair

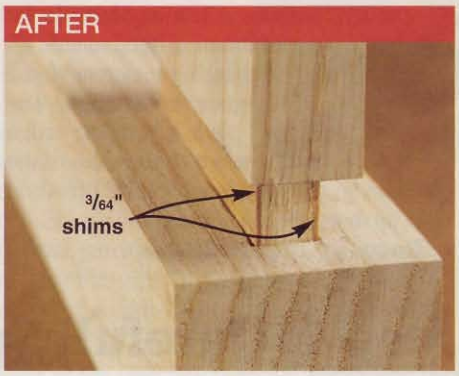
Some joints go wrong no matter how carefully we measure or work. The slip of a tool, a moment's distraction, or a pinch of sawdust trapped against a stop results in a joint that wiggles or shows a gap. Don't get mad; get the joints even. Developed during his 22 years of woodworking experience, joinery expert Marc Adams teaches these joint fixes at his woodworking school in Franklin, Indiana.

1 Fill small gaps. Patch gaps, such as the one at *right*, with sanding dust from matching wood mixed with clear, five-minute epoxy the consistency of peanut butter. Use epoxy instead of glue because some filler inevitably winds up smeared alongside the joint line, and epoxy dries on the surface of the wood instead of soaking in. Simply sand off this excess filler to avoid finishing problems. Select this gap-filling method when the issue is appearance, not strength.

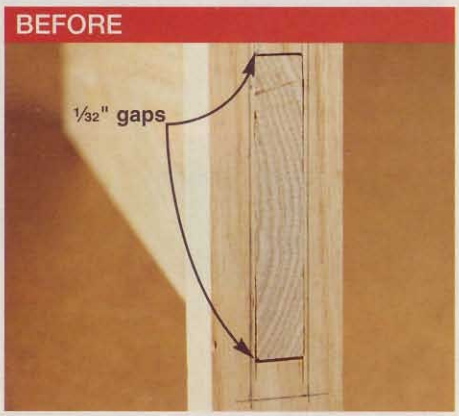


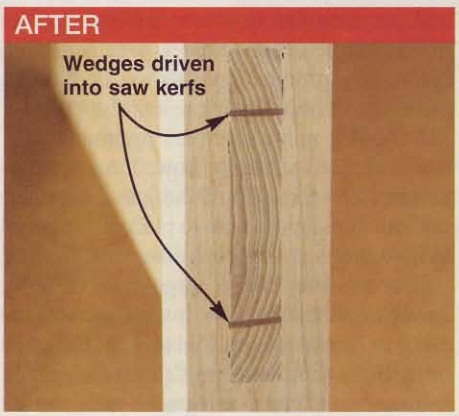
2 Add wood shims. When a tenon rattles in its mortise during a test fitting, you know the joint won't last. Filling a gap with glue sacrifices strength, so take a moment to build up the too-narrow member with wood, as shown at *right*. Cut two fillers that will make the tenon slightly thicker than needed. Glue a piece on each face cheek of the tenon. After the glue dries, trim the tenon to fit snugly into the mortise.





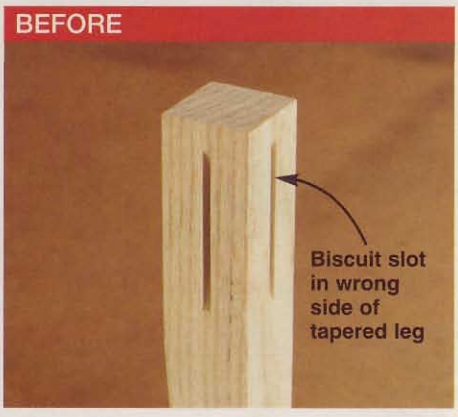
3 Create a design element. Occasionally, it's better to show off a repair than to hide it. For the undersize ash tenon shown at *right*, we sawed two slots and drove in thin pieces of cherry, tapered at the bottom end, to wedge the tenon tightly in its through mortise. In other situations, such as a blind mortise-and-tenon joint in an out-of-the-way spot, rounded or chamfered edges distract the eye from slight gaps in a joint.





4 Replace the part. It happens to all of us: We make a noticeable mistake that's not worth fixing for one of two reasons: (1) No matter how skilled and careful you are, the repair will be obvious and unattractive, or (2) it's simply quicker and easier to discard the flawed part and make a new one. Prepare for situations like the one shown at *right* by grabbing an extra board or two when buying lumber for your project.

Written by **Jim Pollock** with **Jeff Mertz**



To ensure that each test joint received the same amount of glue, we screeded away the excess with the threads of a bolt. The test pieces were then clamped into a pneumatic vise.

SHOP-TESTED

woodworking glues

Here's what separates the stuff we use to put things together.

Chances are that one of the most used "tools" in your shop is glue. It's a rare project that doesn't require some. But have you ever stopped to ask yourself if you're using the right type or brand of glue for the best results? To help out, we tested 15 common glues, making and breaking more than 700 joints in the process.

Perhaps you don't think much about the glues you use, grabbing whatever is on the shelf. Or you may obsess over choosing the perfect glue for the situation. Our tests show that such concern may be misplaced because, with a well-made joint, almost all glues are stronger than the wood they bond.

But that doesn't necessarily mean just any glue will do for every project. The complexity of the assembly and where the project will be used (indoors or out) may determine your final glue choice. To learn which workshop adhesives work best, we gathered polyvinyl acetate (PVA, often referred to as "yellow"), water-resistant PVA, and polyurethane glues and put them through a battery of tell-all tests.

How we "put the screws" to the tested glues

We conducted our tests using hard maple because it is strong and closed-grained. For consistency, all similar tests were conducted on samples from the same board. A Freud LM74R Glue-Line Rip blade cut the mating sides of each joint and provided us with a smoother gluing surface than that left by a jointer.

After spreading a heavy coating of glue on both sides of the joint (usually edge grain to edge grain, but also edge grain to end grain) we removed the excess, as shown at *left*. For most of the tests, we then immediately assembled the joints. For polyurethane glues, which require some moisture to cure, we applied glue to just one joint surface and wiped the mating side with a damp cloth prior to assembly.

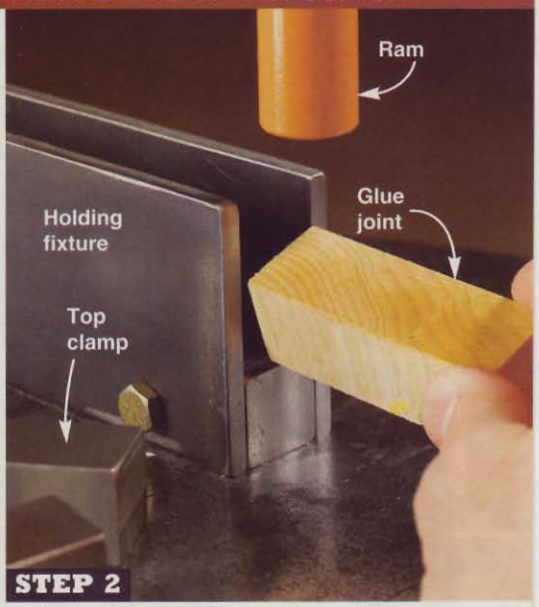
All joints were clamped in a pneumatic vise (shown in **Step 1**) set to clamp with exactly 150 pounds per square inch (psi) of pressure, the pressure recommended by glue manufacturers. Except for the "speed of set" test (see *page 83*), the sample joints were removed from the vise after two hours. (Polyurethanes set slow, so those joints were clamped for four hours.) All joints were then allowed to cure for at least 72 hours before we tried to break them.

For that task, we built a special fixture, shown in **Step 2**, to hold the workpieces, and mounted it on a 12-ton press. Watching a gauge that measured the pressure being applied to the glued-up test sample, we steadily increased the shearing force on the sample (**Step 3**) until the joint (or wood) broke, and recorded the gauge reading.

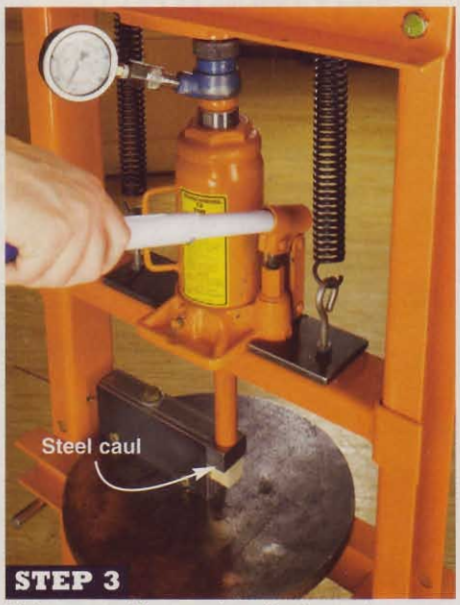
If one fourth or more of the joint was exposed by the break, we considered that a failure of the glue. If less than one fourth of the breakage occurred along the joint line, we considered it a wood failure. (See examples of both in **Step 4**.)

TESTING GLUE JOINTS: A 4-STEP, MAKE-AND-BREAK PROPOSITION

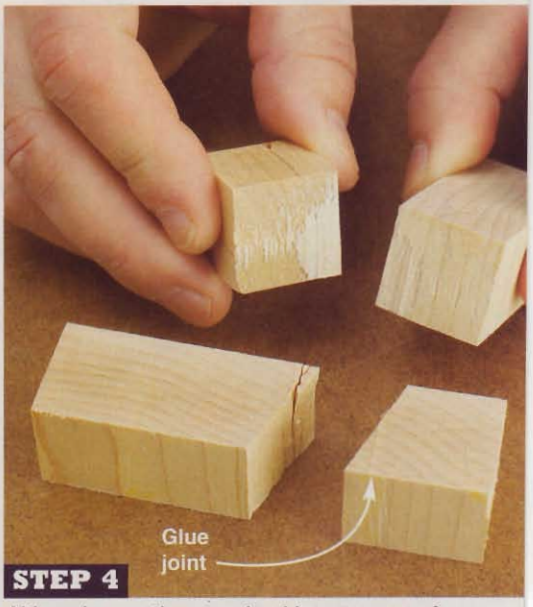
A Heinrich air vise (heinrichco.com) applied precisely 150 psi of pressure to the glued up blanks. We then cut each blank into 1"-wide samples to fit our joint-breaking jig.



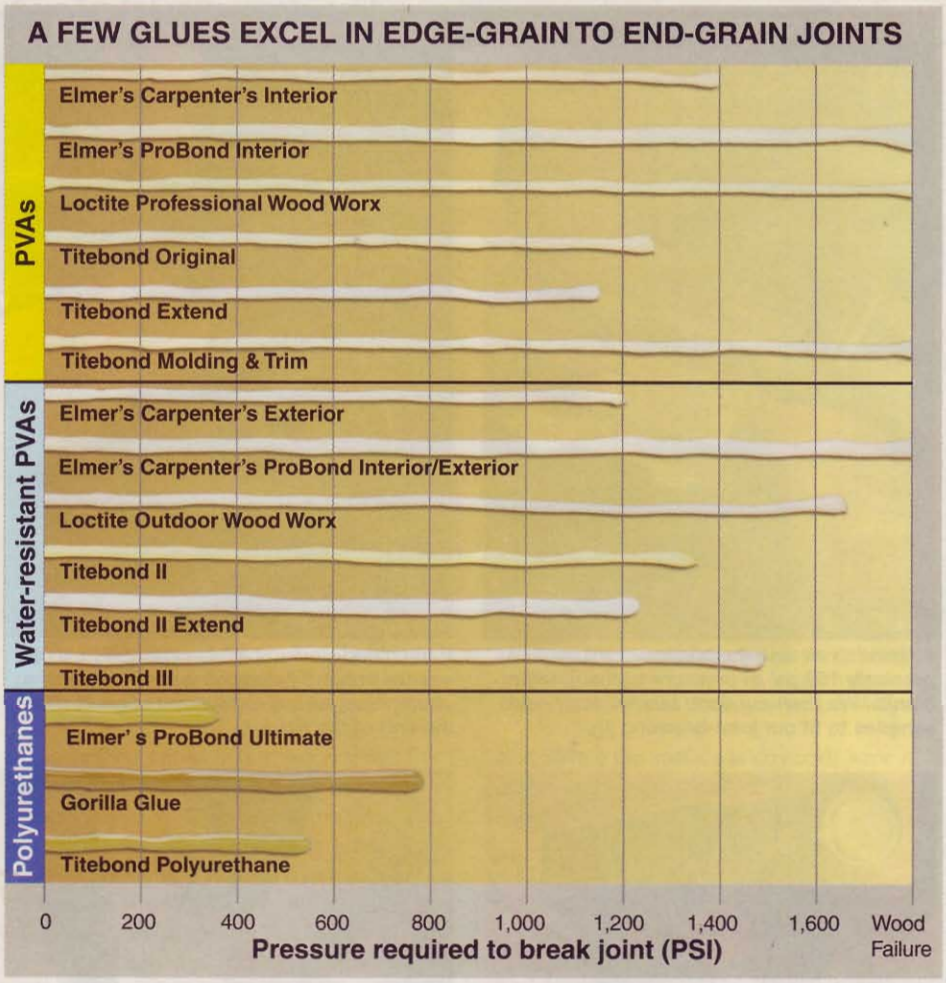
Each glued-up sample was clamped into a special holding fixture beneath the ram of a shop press, with the glue joint aligned with the end of the fixture.



Using a steel-bar caul to distribute the ram pressure equally, we steadily increased pressure until the glue joint—or the wood—broke with a loud crack.



Although a portion remained intact, most of the end- to edge-grain joint (in hands) failed. The edge- to edge-grain joint (foreground) proved stronger than the wood itself.

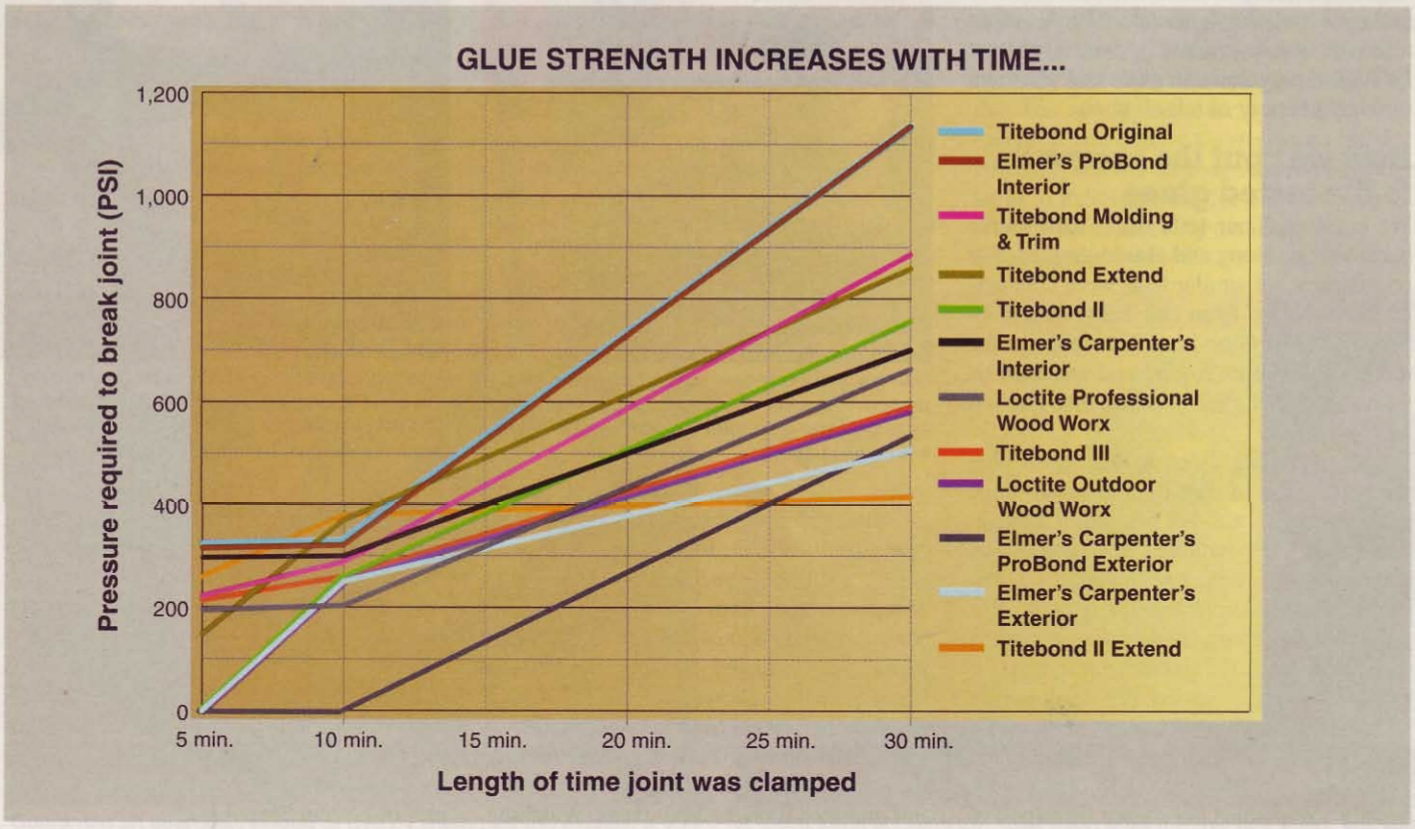


Three major sticking points for glues

So, what qualities are important when it comes to putting your projects together and deciding which glue to buy? Here are the top three in our book.

1 ***Strength of bond.*** Our first test was joining edge grain to edge grain (as when gluing up a tabletop or panel), and with virtually every glue, the wood broke before the glue joint. The only exception was Titebond Polyurethane, which failed under a respectable average of 1,650 psi of shearing pressure. Titebond's Dale Zimmerman told us, "Polyurethane glues would normally be expected to produce wood failure in this type of assembly," but also noted, "the dependence of the polyurethane glues on moisture for curing means that differences in the moisture levels present could affect the quality of the bonds achieved."

Next, we made edge-grain to end-grain joints, such as those between the rails and stiles on a face frame. Because of the way end grain drinks in liquid, we didn't expect any of the glues to do well here. However, as you can see from the chart at *left*, four glues—Elmer's ProBond Interior and ProBond Interior/Exterior, Loctite Professional Wood Worx, and Titebond Molding and Trim—proved stronger than the wood here too. Polyurethanes, as a group, failed under

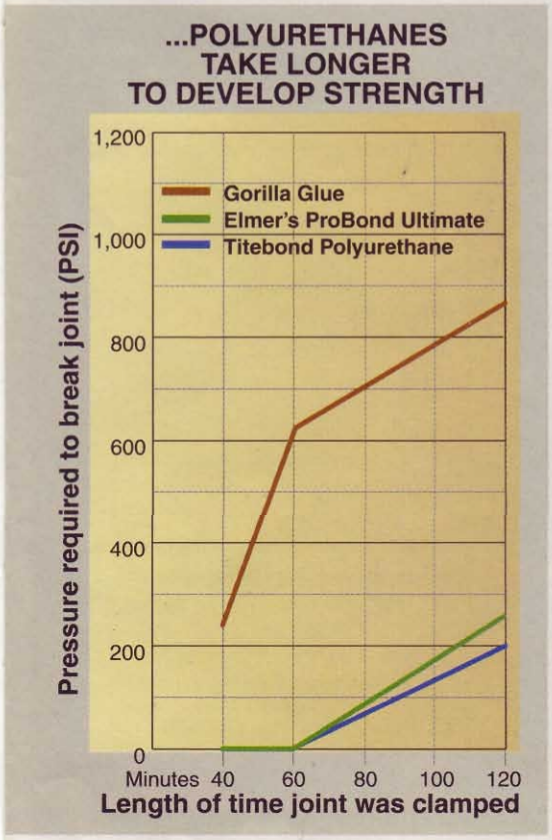


much less pressure than other types of glues in this test. Remember that with any edge-grain to end-grain joint it's a good idea to reinforce that joint with biscuits, dowels, screws, or other joinery techniques, such as cope-and-stick or mortise-and-tenon.

2 ***Speed of set.*** With many of today's woodworking glues, you can unclamp an assembly in as little as 30 minutes without affecting the strength of the bond. That doesn't mean you can start machining a joint a half hour after making it—glue manufacturers still recommend at least 24 hours of curing before putting stress on a joint. But, with a fast-setting glue, you can reclaim your clamps sooner for the next glue-up.

To find out how quickly each glue develops strength, we glued up and clamped sample edge-to-edge joints, and then removed them after 5, 10, and 30 minutes for PVAs and water-resistant PVAs (40, 60, and 120 minutes for polyurethanes). Immediately after removing them from the vise, we measured the pressure required to break the joints. The charts *below* show the results of these tests.

None of the glues showed sufficient strength at the 5- and 10-minute marks. After 30 minutes in the vise, Elmer's ProBond Interior and Titebond Original developed the most strength, requiring more than 1,100 psi to break the joints. All



Four more adhesives you should know about

■ **White glue.** In our tests, we found that white glue bonds with as much strength in edge-grain to edge-grain joints as any PVA or water-resistant PVA, but performed as poor as poly in edge- to end-grain joints. Its key property, though, is its long open time; and before the days of Titebond Extend and Titebond II Extend, white glue was the only way to work with complicated assemblies. If you can't find Extend formulations where you buy glue, consider white glue as a substitute.

■ **Hide glue.** Made from animal hides, it's favored by musical-instrument makers and furniture restorers because warm water softens the glue, allowing the joint to be disassembled and reassembled without damaging the wood. Crystal hide glue smells foul, and in our tests fell far short of the bonding strength of today's bottled glues.

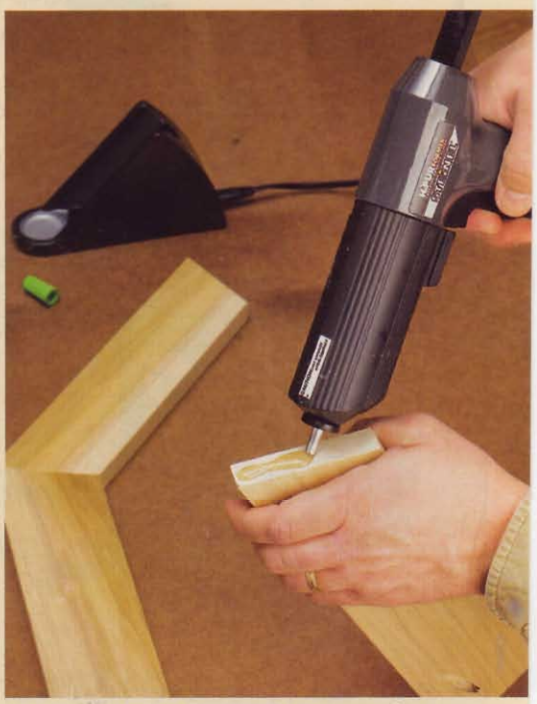
However, Titebond's Liquid Hide glue, made from the same basic stuff as crystal hide, is cooked at the factory with stabilizers added, and performed on par with PVA glues in the strength-of-bond and heat-resistance tests. Yet joints made with Liquid Hide separated easily in the presence of moisture, just like crystal hide. With the performance, price, and availability of Liquid Hide, we can't make a strong case for using crystal hide in your projects.

■ **Epoxy.** We like two-part epoxy in the *WOOD®* magazine shop because it bonds wood to almost anything, including nonporous materials, such as glass, steel, and brass. Structural epoxy (labeled with a one-hour or longer working time) is waterproof and approved for submersion, which explains why it's a favorite among boat builders. It also bonds well with oily exotic woods, such as teak. The edge-grain to edge-grain joints we made with epoxy in teak were stronger than the wood itself.

■ **Hot-melt polyurethane.** Although the furniture industry has long used this fast-setting glue, it has been available to consumers for only about two years. Like hot-melt craft glue, HiPURformer glue cures quickly as it cools, so you can literally "clamp" a joint for less than a minute with your bare hands. But the bond formed by hot-melt polyurethane is far stronger. In fact, we made end-grain to end-grain joints with HiPURformer and they held up to nearly 1,200 psi of shearing pressure before breaking.

Impressive performance comes with a high price tag, though. The HiPURformer system costs $100, with 50-gram replacement glue cartridges (about 70 linear feet of adhesive) running $7 each.

Traditional hide glue comes in dry crystals that you mix with water and heat in a pot. Titebond's premixed Liquid Hide glue proved far stronger and easier to use in our tests.



Titebond's HiPURformer system uses glue cartridges in a heated gun, and the three formulations of glues have different open times (30, 60, and 75 seconds).

of the water-resistant PVAs achieved about equal strength in this time, with break pressures of 400–600 psi.

Polyurethane glues require much more time to develop strength, with manufacturers recommending from one to four hours before removing clamps. Our tests showed that Gorilla Glue cures fastest of the polys, as you can see from the chart.

3 ***Open time.*** This term refers to the length of time a glue can be exposed (or *open*) to the air before assembly with no loss of bonding strength. The longer time gives you more minutes to put together complex assemblies, such as gluing a long row of slats into a headboard.

For each glue, we applied and screeded the glue, and then left the joints open for a specific series of times—4, 8, 12, and 20 minutes for most glues; and 8, 15, 25, and 45 minutes for polyurethanes—then clamped the joints. After letting the glue properly cure, we recorded the pressure required to break each joint.

At 12 minutes of open time, all of the PVAs and water-resistant PVAs proved stronger than the wood they bonded. At 20 minutes, however, all glue joints failed except those made with Titebond Extend, Titebond II Extend, and Titebond III, which remained intact.

Polyurethanes rule when it comes to long open times, with sample joints left open for 45 minutes still stronger than the surrounding wood. However, these glues expand as they cure, sometimes foaming out of the joint and leaving a tough residue that is difficult to clean up. If you've not worked much with polyurethane and want to use it on a critical project, we suggest making practice joints in scrap and letting them cure for several hours to get a feel for how much polyurethane is too much.

Two more tests for special situations

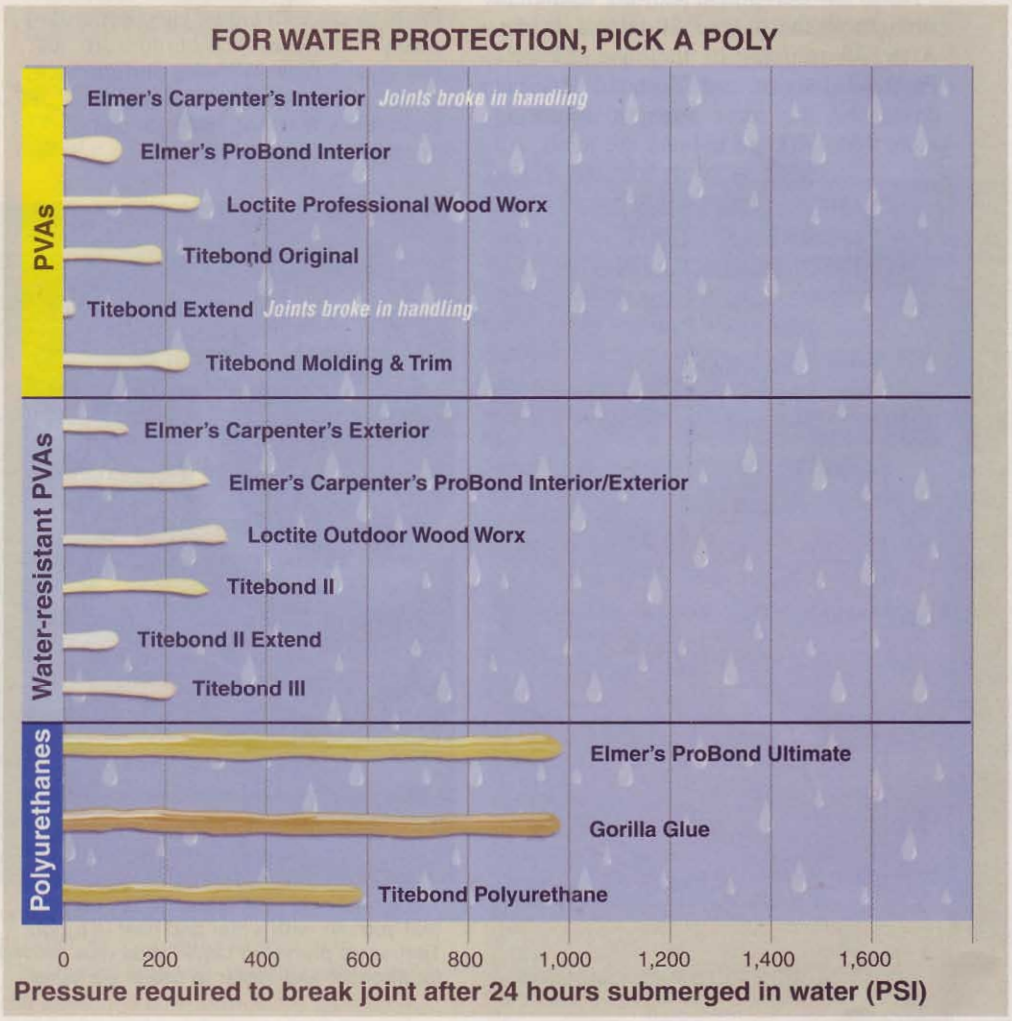
1 ***Water resistance.*** Projects that must withstand the rigors of the outdoors benefit from a glue designed for that purpose. To test these glues, we submerged the joints in water for 24 hours, and then tried to break them. (Note that this test is severe: None of the glues are rated for long-term submersion.) Some of the glue joints broke before we could get them into our testing fixture; most of the others—including the water-resistant glues—were only a bit better. Two glues stood head and shoulders above the others in this test: Elmer's Ultimate and Gorilla Glue, both polyurethanes.

3 surprising lessons I learned from this test

1 In my junior-high shop class, we used crystal hide glue exclusively, so I've always held it in high esteem. No more. Today, I would choose almost any glue over crystal hide.
2 I've always saved my glue-ups for the end of the day so I could let them cure overnight in the clamps. Now I see that, except for polyurethanes, I can trust glue joints clamped for 30–60 minutes and get more joints done in a day.
3 I never really gave much thought to the glue bottle itself, but attached pop-up caps make the job easier. Small, round, loose caps roll off the bench and get lost in sawdust.

—Product tester Dean Fiene

Round bottle caps (foreground) tend to roll away and get lost. The larger Loctite caps have flat sides to prevent rolling, but the captured caps on Titebond bottles are impossible to misplace.



Should you apply glue to one side or two? It's up to you

Curious about this ages-old woodworking question, we made edge-to-edge joints both ways using Titebond Original. We left both joints open to the air for five minutes before assembly.

After clamping, curing, and cracking, we found insignificant differences in bonding strength. Bottom line: You can save time by applying glue to only one side of a joint without worrying about weakening it. Just remember to apply enough glue to that one surface to create squeeze-out along the entire joint line.

2 ***Heat resistance.*** You might not think about it, but some of your projects may be subject to high temperatures. A fireplace surround or the cabinets in an Arizona "winter" home that's closed during the summer are two examples of high-heat situations. For the rest of us, the more heat resistant a glue, the less likely it is to gum up your abrasives during sanding operations where wood surface temperatures can rise dramatically.

After subjecting cured glue joints to a 150°F oven for 24 hours, we immediately tried to break them in our testing rig. All of the joints made with Elmer's Carpenter's Interior/Exterior outlasted the wood. But of the glues with joint breakage, most easily surpassed 1,800 psi of shearing pressure. Joints made with Elmer's Carpenter's Interior and all of the polyurethanes broke under 1,500 psi or less of shearing pressure.

Written by **Dave Campbell** with **Dean Fiene**

GLUE SCHOOL: 15 PRODUCTS GRADED

BRAND	FORMULATION	TYPE OF GLUE (1)	PERFORMANCE GRADES: STRENGTH OF BOND: EDGE GRAIN TO EDGE GRAIN (2)	STRENGTH OF BOND: EDGE GRAIN TO END GRAIN (2)	LENGTH OF OPEN TIME (MINUTES) (3)	SPEED OF SET (4)	HEAT RESISTANCE (2) (5)	WATER RESISTANCE (6)	COST PER OUNCE (7)
ELMER'S	Carpenter's Interior	PVA	A	C+	12	C	C	F	$0.23
	ProBond Interior	PVA	A	A	12	A	B+	D	.33
LOCTITE	Professional Wood Worx	PVA	A	A	12	C	B	C	.35
TITEBOND	Original	PVA	A	C	12	A	B	C	.31
	Extend	PVA	A	C	20	B	B+	F	.37
	Molding and Trim	PVA	A	A	12	B	D	C	.34
ELMER'S	Carpenter s Exterior	WR	A	C	12	C-	A	D	.31
	ProBond Interior/Exterior	WR	A	A	12	C-	D+	C	.33
LOCTITE	Outdoor Wood Worx	WR	A	B	12	C	C	C	.35
TITEBOND	II Premium	WR	A	C	12	C	B+	C	.34
	II Extend	WR	A	C	20	C	C	D	.41
	III Ultimate	WR	A	B	12	C-	B	C	.53
ELMER'S	ProBond Ultimate	PU	B	F	45	D	C-	A	.85
GORILLA GLUE	Gorilla Glue	PU	A	F	45	B	C	A	1.11
TITEBOND	Polyurethane	PU	C+	F	45	D	C-	B	1.08

NOTES:

1. (PU) Polyurethane
   (PVA) Polyvinyl acetate
   (WR) Water resistant PVA
2. A Wood always failed before glue joint.
   B Some joints failed under high pressure.
   C Some joints failed under moderate pressure.
   D All joints failed under moderate pressure.
   F All joints failed under low pressure.
3. Length of time glue can remain exposed to air and still achieve full-strength bond.
4. Strength of bond after clamping 30 minutes for yellow and water-resistant glues; 120 minutes for polyurethanes.
   A Excellent
   B Good
   C Average
   D Below average
5. Strength of bond after heating for 24 hours at 150°F.
6. A Excellent
   B Good
   C Average
   D Below average
   F Joint separated in water or during handling
7. Based on price of 12–18 oz. bottle at time of article's production.

FOR MORE INFORMATION, CONTACT:

Elmer's	888/435-6377	elmers.com
Gorilla Glue	800/966-3458	gorillaglue.com
Loctite	800/321-0253	loctiteproducts.com
Titebond	800/669-4583	titebond.com

These are the glues we would choose

As we noted at the outset, almost all of the glues—in a well-made edge-to-edge joint—exceed the strength of the wood itself. Only four glues also outperformed the wood in more difficult edge-to-end grain joints: Elmer's Probond Interior and Probond Interior/Exterior, Loctite Professional Wood Worx, and Titebond Molding & Trim. Of these, Probond Interior developed strength fastest in our tests, so it's our Top Glue for interior projects. If you need a little more working time for complicated glue-ups, either of Titebond's Extend glues will buy you an extra 10 minutes or so, without the sometimes messy cleanup of a polyurethane glue.

For outdoor projects, Gorilla Glue is our first choice. It was the only polyurethane that didn't break in our edge-to-edge joint test, it developed strength faster than the other polys, and tied with Elmer's ProBond Ultimate as the strongest joint after being submerged for 24 hours. Like all polyurethanes, it's pricier than PVAs, at around $1 per ounce.

water garden under glass

Make this simple yet elegant base in an evening, and then add an inexpensive globe, a little water and vinegar, and your favorite blossom to create a stunning accent piece.

Though the rings of this eye-catching base look like they're turned, surprisingly you make them using a bandsaw, scrollsaw, and drum sander. After assembling two small miter-cut frames, you just lay out the rings, and cut and sand them to shape. To complete the base, glue the rings and the easy-to-make feet together.

Get engaged with the rings

1 To form the top and bottom rings, where shown on **Drawing 1**, first prepare two 2×30" blanks—one ⅝" thick for the top ring and the other ¾" thick for the bottom ring—from a wood of your choice. (We used cherry for the base's rings and ash for the feet.)

2 Miter-cut four 6¾"-long pieces from each blank. Then, glue and clamp the pieces together to make the frames, where shown on **Drawing 2**, keeping the joints tight and flush.

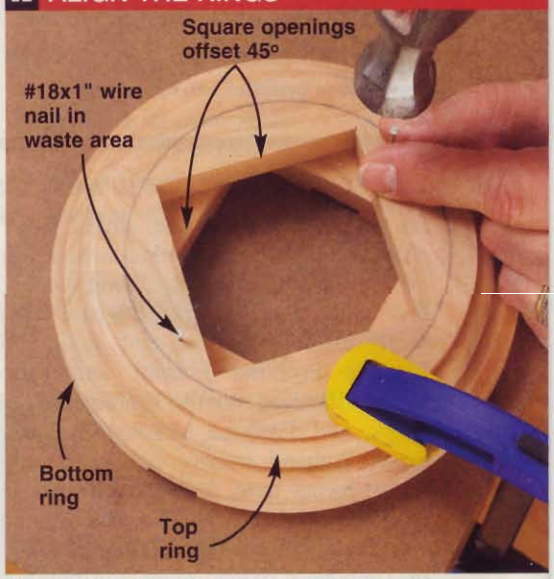
3 Using a dado blade in your tablesaw, cut ¾" dadoes 3/16" deep, centered, across the bottom of the bottom-ring frame, where shown, to receive the feet.

4 From ¾"-thick scrap, cut a 2¾"-square plug to fit into the frames' openings. Draw diagonals on the plug to find its center. Then, place the plug in the bottom-ring frame. Centering a compass on the plug, draw a circle (cutline) with a 3⅛" radius for the ring's outside diameter, where shown. (You don't need to mark this ring's inside diameter.) Now, place the plug in the top-ring frame, and draw circles with 2⅛" and 2¾" radii for the ring's inside and outside diameters. Remove the plug.

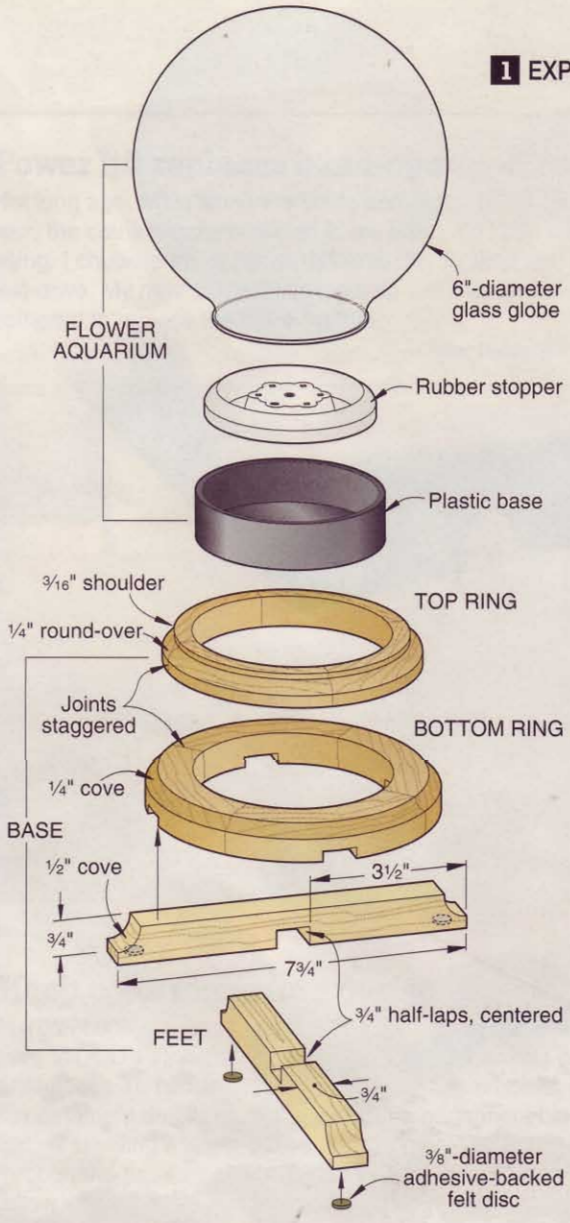
5 Bandsaw the outside of the rings to shape, cutting close to the cutlines and then sanding to the lines using 120-grit sandpaper. To form perfect circles, use a disc sander circle jig. (For a free jig plan, go to woodmagazine.com/circlejig.)

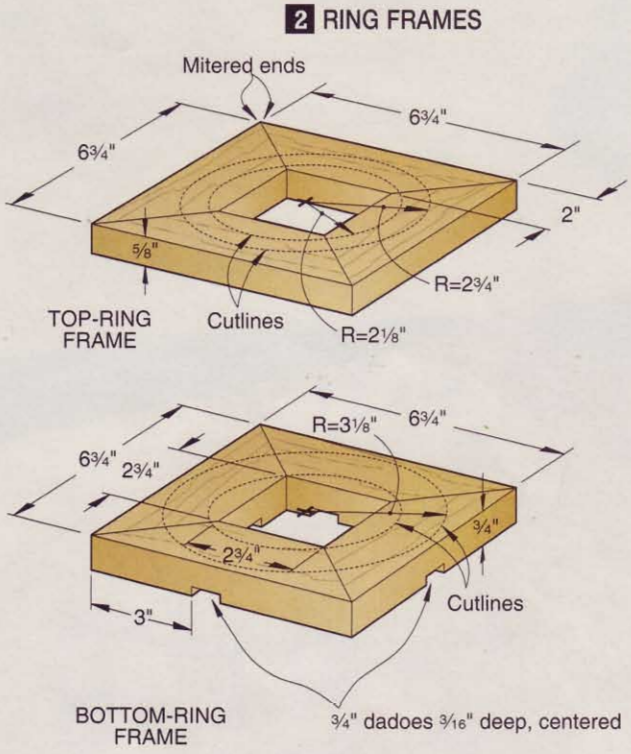
6 Using your table-mounted router, rout a ¼" round-over with a 3/16" shoulder along the top ring's top edge, where shown

A ALIGN THE RINGS



To keep the rings aligned during glue-up, drive two #18×1" wire nails through the waste area in the top ring and ⅛" into the bottom ring.





Apply glue to the half-laps in the feet and to the dadoes in the bottom ring. Assemble the feet, and clamp them to the ring assembly.

on **Drawing 1**. Then, switch to a 1/4" cove bit, and rout a cove along the bottom ring's top edge.

7 With the rings face-up, center the top ring on the bottom ring with the square openings offset 45° to stagger the rings' joint lines, where shown. Temporarily fasten the rings together with wire nails, driving them in only partway, as shown in **Photo A**. Separate the rings, leaving the nails protruding from the top ring so that you can easily realign it with the bottom ring. Then, apply glue, assemble the rings, and clamp them together.

8 When the glue dries, remove the nails. Then, using your scrollsaw with a #7 blade with 10 teeth per inch, cut the *inside* of the ring assembly to shape, staying just inside the top ring's cutline. Then, sand to the line using a 100-grit drum sander in your drill press or an oscillating spindle sander.

Now, add the feet and finish

1 From 3/4"-thick stock, cut two 3/4×7 3/4" pieces for the feet. Using your table-mounted router and an auxiliary fence attached to the miter gauge to avoid tear-out, rout a 1/2" cove along both ends of the feet, where shown on **Drawing 1**.

2 Using a dado blade in your tablesaw, cut 3/4" mating half-laps centered in the feet, where shown. (To ensure a flush-fitting joint, we made test cuts in cutoffs first.) Now, glue the feet to the ring assembly, as shown in **Photo B**.

3 Sand the base with 220-grit sandpaper, and remove the dust. Apply two coats of a clear finish. We used Deft satin aerosol lacquer, sanding to 320 grit between coats. When the finish dries, apply 3/8"-diameter adhesive-backed felt discs to the bottom of the feet.

4 To prepare the globe and "plant" your flowers, refer to the instructions supplied with the globe. Then, with the rubber stopper and plastic base in place on the globe, set it on the wood base. Now, take a few minutes to enjoy your display's colorful details.

Supplies: #18×1" wire nails (2), 3/8"-diameter adhesive-backed felt discs (4).

Blades and bits: Dado-blade set; 1/4" round-over, 1/4" cove, and 1/2" cove router bits; #7 scrollsaw blade with 10 teeth per inch.

Sources

Flower aquarium. Globe, stopper, and base, no. DB201, $11.50 plus postage. Call Lee Valley, 800/871-8158, or go to www.leevalley.com.

Written by **Owen Duvall** with **Chuck Hedlund**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**

See more great gift project plans at **woodmagazine.com/gifts**

Curly maple and cherry

secret-compartment

jewelry box

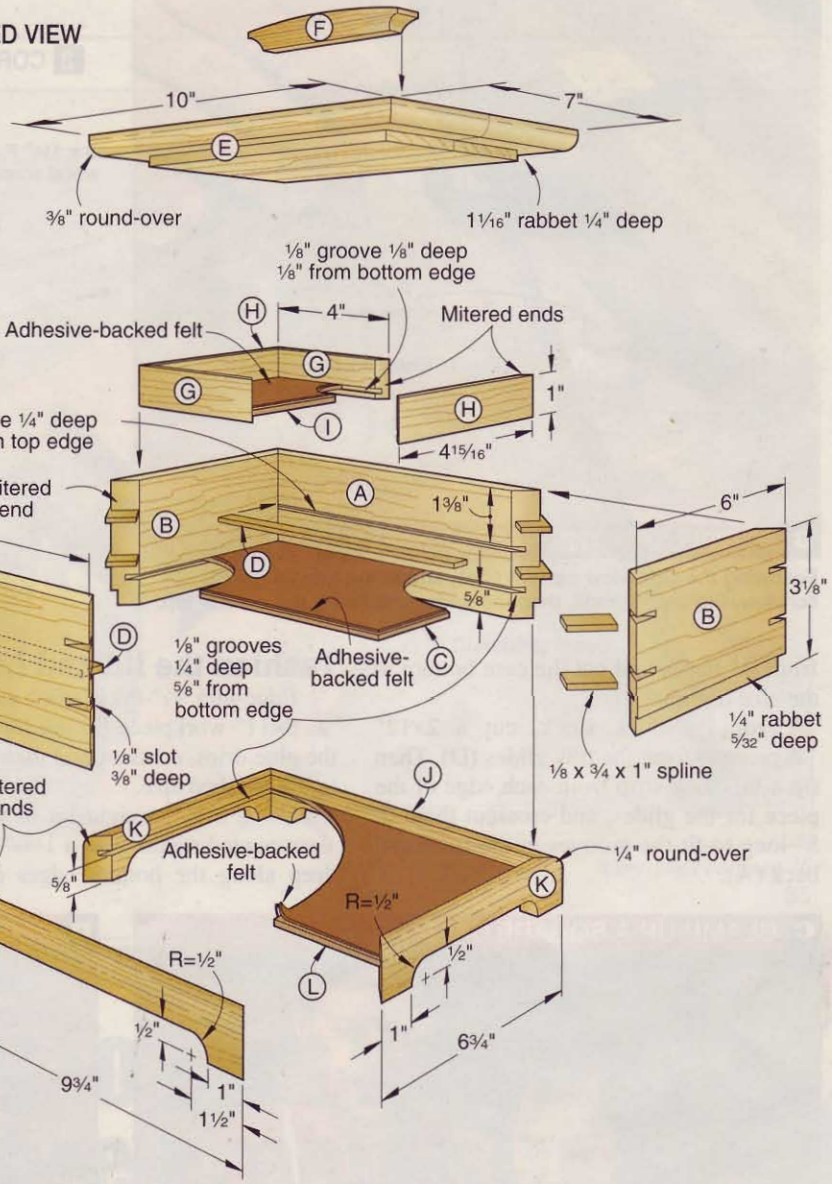
Change the woods and finish for a whole new look!

Walnut and curly maple with a maple golden amber aniline dye applied.

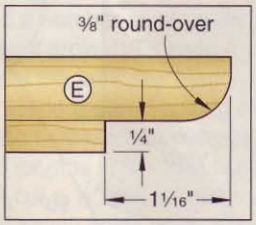
Surprise, surprise...

To access the hidden compartment, simply raise the case off the base and voilà!—a ¾"-high space appears.

1 EXPLODED VIEW



1a LID DETAIL



BUILDING TOMORROW'S WOODWORKERS
WAY COOL
Woodworking Projects

Storage pieces with secret compartments are typically quite complicated to build, but that's not the case with this eye-catching weekend project. With just 12 parts and mitered-corner joinery, its construction is simple and straightforward. We even show you how to share the experience of building it with a youthful recipient, as I did with my 13-year-old daughter, Victoria.

Owen Duvall
Projects Editor

Note: After preparing the parts as explained in the first four sections of this article, have your young partner join forces to complete the machining and assembly, starting with the section identified by the adult/teen icon on page 91.

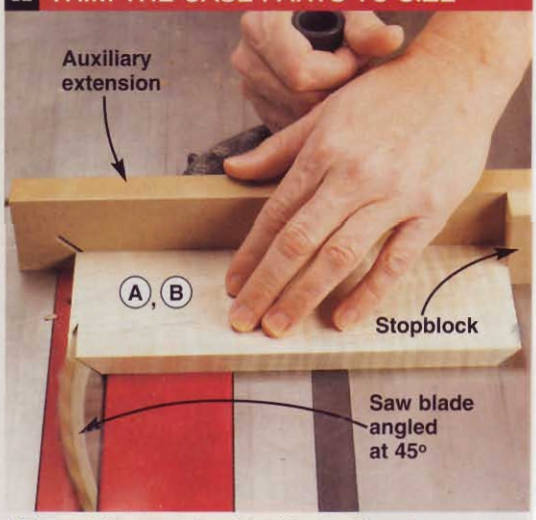
Start with the case parts

1 With your teen observing from a safe distance, cut from ½"-thick stock a 3⅛×34" piece to form the case front and back (A) and sides (B). Crosscut the parts from the blank ¼" longer than the lengths listed in the **Materials List**. To maintain a continuous grain flow, cut the parts in sequence (left side, front, right side, back), as shown on the **Cutting Diagram**. Number the parts on the outside face, and mark the bottom edge.

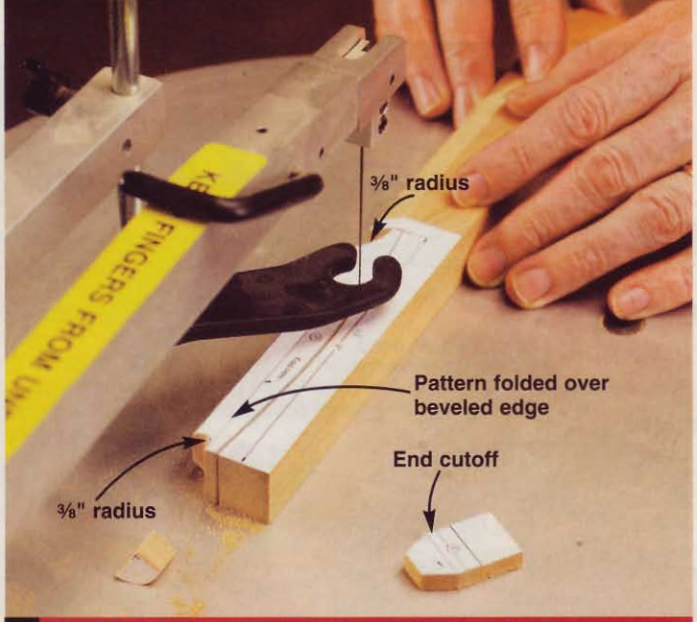
2 With your tablesaw blade angled at 45°, miter-cut one end of each part. Then, miter-cut the other ends to trim the parts to the finished lengths, as shown in **Photo A**. (Your partner will cut the slots for the splines and rabbet the bottom outside edge of the case after it's assembled.)

3 Cut a ⅛" groove ¼" deep 1⅜" from the *top* edge of the front and back (A) on the *inside* face to receive the tray glides (D), where shown on **Drawing 1**. Then, changing only your fence position, cut a groove on the *inside* face of the front, back, and sides (A, B) ⅝" from the *bottom* edge to accept the case bottom (C). Now

A TRIM THE CASE PARTS TO SIZE

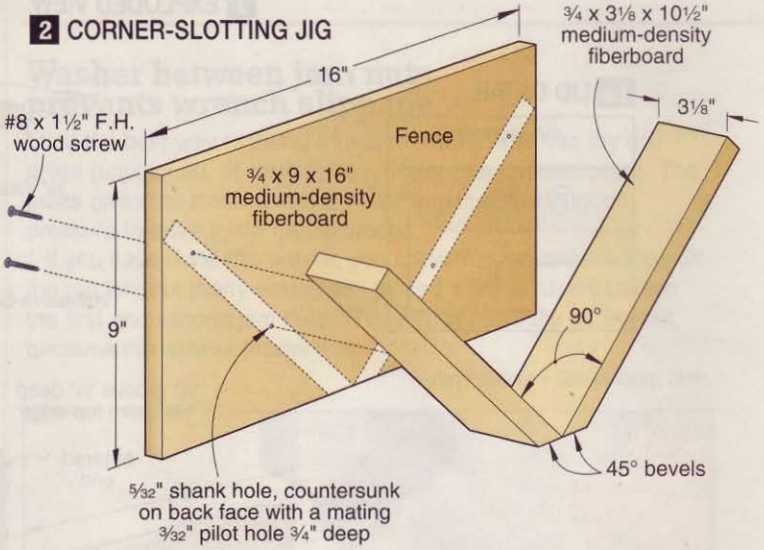


Miter-cut the case front and back (A) and sides (B) to the finished lengths, using a stopblock to ensure identical length parts.



B SCROLLSAW THE HANDLE TO SHAPE

Following the side-view pattern lines, shape the handle (F) by scrollsawing the 3/8" radii, then the ends, and finally the curved top.


2 CORNER-SLOTTING JIG
3/4 x 3 1/8 x 10 1/2" medium-density fiberboard
16"
#8 x 1 1/2" F.H. wood screw
Fence
3/4 x 9 x 16" medium-density fiberboard
3 1/8"
9"
90°
45° bevels
5/32" shank hole, countersunk on back face with a mating 3/32" pilot hole 3/4" deep

from 1/8" hardboard cut the case bottom to the size listed.

4 From 1/2"-thick stock, cut a 2×12" piece to form the tray glides (D). Then rip a 1/8"-thick strip from each edge of the piece for the glides, and crosscut them to 8" long to fit the grooves in the front and back (A).

Fashion the lid and handle

1 Edge-join 3/4"-thick stock to make an 8×11" workpiece for the lid (E). After the glue dries, crosscut and then rip the lid to the finished size.

2 Using a 3/4" straight bit in your table-mounted router, rout a 1 1/16" rabbet 1/4" deep along the bottom edges of the lid, where shown on **Drawing 1**. To avoid chip-out, cut the rabbet in three passes, moving your fence back with each pass. Then switch to a 3/8" round-over bit, and round over the edges of the lid where shown.

3 To form the handle (F), cut a 1 1/4×10" piece from 3/4"-thick stock. Then photocopy the handle side-view and end-view

C CLAMP UP A SQUARE CASE

Keeping the parts in sequence, assemble the case front and back (A) and sides (B) together with the bottom (C) captured in the bottom groove. Draw the assembly snug using a band clamp.

D CUT SLOTS FOR THE CORNER REINFORCEMENTS

Holding the case bottom firmly against the corner-slotting jig fence, slide the jig forward to cut a slot in the case. Rotating the box, cut a slot in the remaining corners.

full-size patterns on the *WOOD Patterns*® insert. Spray-adhere the end-view pattern to an end of the workpiece.

4 With your tablesaw blade angled at 25° from vertical, bevel-rip an edge of the workpiece where shown on the pattern. Then turn the piece end-to-end, and bevel-rip it again. Now spray-adhere the side-view pattern to the workpiece, folding it over the beveled edge where shown on the pattern and as shown in **Photo B**. Using your scrollsaw with a no. 12 blade, cut the handle to shape, as shown. Remove the pattern using a solvent-moistened cloth.

Prep the tray and base parts

1 From ¼"-thick stock, cut a 1×20" piece to form the tray front and back (G) and sides (H). Next, cut a ⅛" groove ⅛" deep ⅛" from an edge of the piece for the tray bottom (I). As you did for the case, cut the front, back, and sides ¼" longer than the listed lengths, and then miter-cut them *to exact size. Now cut the ⅛" hardboard* bottom to size.

2 From ½"-thick stock, cut a 1⅛×36" piece for the base front and back (J) and sides (K). Then cut a ⅛" groove ¼" deep ⅝" from an edge of the piece for the base bottom (L). Miter-cut the front, back, and sides to their finished lengths. (Your partner will lay out and form the cutouts in these parts.) Now cut the ⅛" hardboard bottom to size.

Make the splines and a jig

1 To make the splines for the case corners, first cut a kerf in scrap with the blade you'll use to cut the slots in the case. Use a blade that produces the flattest possible kerf bottom. (We used an outside blade from our dado set.) Then, from a ¾×2×12" piece of cherry, rip a strip from its edge with a thickness that matches the kerf—usually ⅛". Now crosscut eight 1"-long splines from the strip.

2 For your partner to easily and safely cut the slots in the case, make the simple corner-slotting jig shown on **Drawing 2**.

Put together a winning case

1 Using a random-orbit sander with 120-grit sandpaper and progressing to 220 grit, let your partner sand all of the parts except the splines and hardboard bottoms.

2 Apply glue to the mitered ends of the case front and back (A) and sides (B) and to the edges of the case bottom (C). Ensuring the front, back, and sides are in the correct sequence, assemble the case as shown in **Photo C**. Check for square and tight mitered corners.

3 After the glue has dried, have your companion cut the spline slots in the case using the corner-slotting jig. To cut the lower slots, raise your saw blade ⅜" above the surface of the saw table, and adjust your tablesaw fence to position the front face of the jig fence 1⅛" from the inside edge of the blade, as shown in **Photo D**. Cut the slots as shown and where dimensioned on **Drawing 1**. Then position the jig fence 2⅛" from the blade, and cut the upper slots.

4 Glue the tray glides (D) in the grooves in the case. Next, glue the splines in the case corners. Let the glue dry overnight. Then trim the splines flush with the case, as shown in **Photo E**. Sand the edges of the splines smooth.

5 Chuck a ¼" rabbeting bit in your table-mounted router. Then rout a ¼" rabbet 5/32" deep along the bottom outside edges of the case, where shown on **Drawing 1** and as shown in **Photo F**.

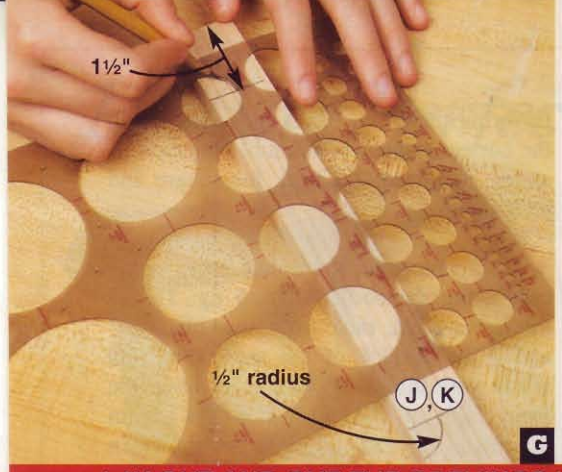
6 Glue and clamp the handle (F) to the lid (E), centering the handle side-to-side and front-to-back.

E FLUSH-TRIM THE SPLINES

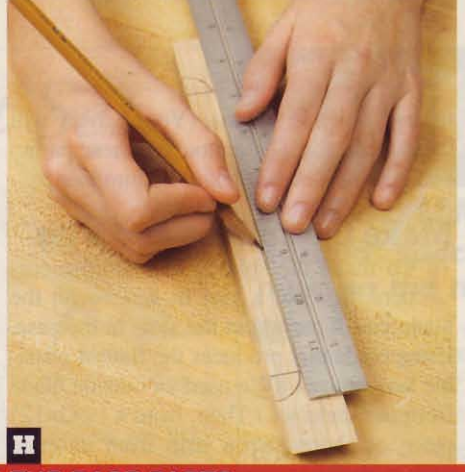
Using a fine-tooth handsaw, such as a flush-trim or Dozuki saw shown *here*, trim the splines flush with the case. Keep the saw flat against the case to avoid marring it.

F RABBET THE CASE BOTTOM

With the bottom of the case held tight against the router-table fence, move the case at a steady rate across the bit to cut a ¼" rabbet 5/32" deep along the case edges.



G


H

I

LAY OUT AND CUT THE OPENINGS IN THE BASE PARTS

Using a circle template, mark ½" radii 1½" from the ends of the base front and back (J) and sides (K) on the bottom edges.

To complete the layout for the opening on each of the base parts, draw a line connecting the radii, using a steel rule as a guide.

Using a no. 12 blade in your scrollsaw, cut the profile to shape, staying just inside the layout lines.

Complete the tray and base

1 Glue and assemble the tray front and back (G), sides (H), and bottom (I), checking for square. (Because the tray is small, we wrapped a small piece of easy-release painter's tape around each corner to hold the joints tight instead of using a band clamp.)

2 To form the cutouts in the base front and back (J) and sides (K), where shown on **Drawing 1**, let your partner lay out the openings, as shown in **Photos G** and **H**, and then scrollsaw them to shape, as shown in **Photo I**. Using a 1"-diameter 120-grit sanding drum in your drill press or an oscillating spindle sander, sand the openings smooth to the layout lines.

3 Glue, assemble, and band clamp the base front, back, sides, and bottom together, checking for square. After the glue dries, rout a ¼" round-over along the top edges of the base, where shown on **Drawing 1** and as shown in the **Shop Tip** *below*.

Add the finishing touches

1 Sand any areas that need it with 220-grit sandpaper, and remove the dust. Apply three coats of a clear finish. (We used Deft aerosol Semi-Gloss Clear Wood Finish, sanding to 320 grit between coats. For safety reasons, we recommend that the adult do the finishing in a well-ventilated area.) If you wish to apply an aniline dye (we used Lockwood's water-soluble Early American Maple Golden Amber), sand the case and lid to 320 grit before wiping on the dye. To avoid removing the surface dye when applying the finish, do not sand between the first two coats.

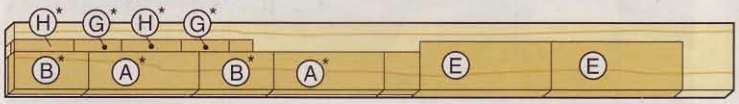
2 Finally, cut pieces of adhesive-backed felt to fit the tray, case, and base bottoms. (We used brown felt—see **Sources**.) Remove the backing, and press the felt to the bottoms. Now have your proud companion place her treasured jewelry in the box, stashing those extra-special pieces in the secret compartment.

SHOP TIP

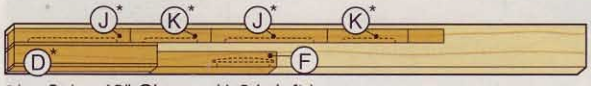
An easy-to-make pushblock ensures safe routing and more

To keep fingers safely away from your bit when routing, use a pushblock, as shown at *right*. You easily can make your own from a ¾×4×4" piece of medium-density fiberboard and a 4" length of ½" dowel glued into a hole drilled in the center of the block. Other benefits: The pushblock lets you easily guide the workpiece while keeping it tight against the fence. It also serves as a backer to avoid chip-out.

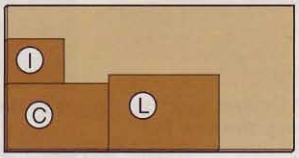
Cutting Diagram



¾ x 5½ x 60" Maple (2.5 bd. ft.) *Plane or resaw to the thicknesses listed in the Materials List.



¾ x 3½ x 48" Cherry (1.3 bd. ft.)



⅛ x 12 x 24" Hardboard

Materials List

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A* case front and back	½"	3⅛"	9"	M	2
B* case sides	½"	3⅛"	6"	M	2
C case bottom	⅛"	5½"	8½"	H	1
D* tray glides	⅛"	½"	8"	C	2
E lid	¾"	7"	10"	EM	1
F* handle	¾"	11/16"	5"	C	1
G* tray front and back	¼"	1"	4"	M	2
H* tray sides	¼"	1"	4 15/16"	M	2
I tray bottom	⅛"	3¾"	4 11/16"	H	1
J* base front and back	½"	1⅛"	9¾"	C	2
K* base sides	½"	1⅛"	6¾"	C	2
L base bottom	⅛"	6¼"	9¼"	H	1

*Parts initially cut oversize. See the instructions.

Materials key: M–maple, H-hardboard, C–cherry, EM–edge-joined maple.

Supplies: Spray-adhesive, easy-release painter's tape. To make the corner-slotting jig: ¾" medium-density fiberboard, 9×16" (1) and 3⅛×10½" (2); #8×1½" flathead wood screws (4). To make the pushblock: ¾" medium-density fiberboard, 4×4"; ½" dowel 4" long.

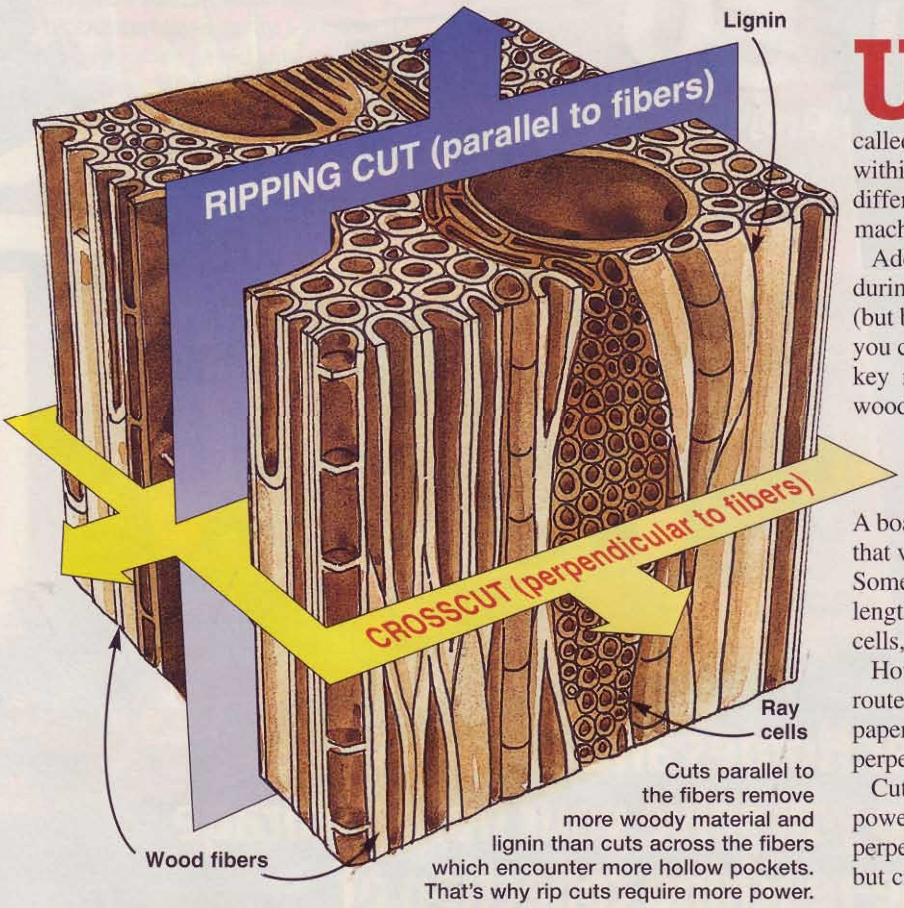
Blades and bits: ¾" straight, ¼" and ⅜" round-over, and ¼" rabbeting router bits; no. 12 scrollsaw blade; ⅛" dado blade.

Sources

Felt. Adhesive-backed felt, 17×24", no. 76K04.01 (green), no. 76K04.03 (brown), or no. 76K04.05 (red), $8.95. Call Lee Valley 800/871-8158; leevalley.com.

Written by **Owen Duvall** with **Jeff Mertz**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**

Part III: make sense of machining


Lignin
RIPPING CUT (parallel to fibers)
CROSSCUT (perpendicular to fibers)
Ray cells
Wood fibers
Cuts parallel to the fibers remove more woody material and lignin than cuts across the fibers which encounter more hollow pockets. That's why rip cuts require more power.

Unlike manufactured materials that have uniform strength, density, and structure (such as plastics), there's little in the makeup of wood that can be called consistent. Variations in cell density and distribution within a board are the norm, not the exception. Boards of different species can react differently during the same machining operation.

Add to those variables the stresses introduced to wood during the drying process, and you have an unpredictable (but beautiful) material. In this article we take a look at how you can best deal with wood's quirky characteristics during key machining steps. First, let's get familiar with basic wood structure.

How cell orientation influences cutting smoothness

A board consists of millions of tiny cells, often called fibers, that vary in size and shape. They're held together by lignin. Some 95 percent of these cells run vertically in trees, or lengthwise in boards cut from those trees. The remaining cells, called rays, run perpendicular to the bulk of the fibers.

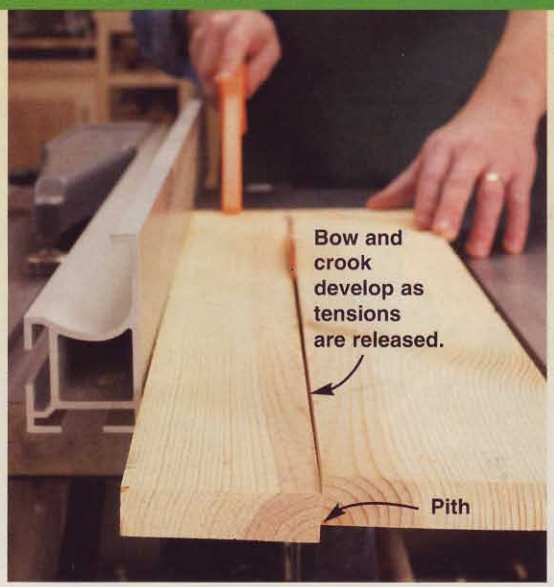
However you cut a piece of wood—with a saw blade, router bit, planer knife, or even abrasive particles on sandpaper—results vary depending whether you cut parallel or perpendicular to the wood fibers, *left*.

Cuts parallel with the fibers, called rip cuts, require more power and tend to heat up cutters, but machine cleanly. Cuts perpendicular to the fibers (crosscuts) generate less heat, but create fuzzing and splintering, called tear-out.

IN-LINE CUTS PRESENT A RIPPING GOOD TIME

If ripping cuts require a lot of power, why do they machine so cleanly? Think of splitting a log with an axe. The blade essentially wedges adjacent fibers apart, causing the lignin to fail and the fibers to rip open lengthwise, which they do easily. Much the same happens when you rip wood using power tools. Blades and bits remove lignin and cut the fibers with a shearing action. This minimizes tear-out and generates heat.

Often, rip cuts reveal hidden stresses in a board caused by the fibers shrinking as the wood dried. Fibers may have been compressed or stretched by those around them, and held in tension within the board until you make a cut. These conditions are inconsistent across the width of the board, especially if it contains reaction wood (from leaning or twisted trees) or was cut near the center (pith) of the log. We've all witnessed the results of these conditions, but may not have known their cause.



The problem:
The kerf closes on a board being ripped.
The solutions:

- Avoid boards containing pith, as well as boards that have inconsistent growth-ring spacing.
- Avoid boards showing signs of improper drying, such as face checks, "honeycomb" cracks, and excessive warping.
- Machine project parts oversize to let the wood release tension. Then resurface and recut the pieces to size, removing the imperfections.
- Keep saw blades sharp and clean.

KEEP AN EYE OUT FOR TEAR-OUT WHEN CROSSCUTTING

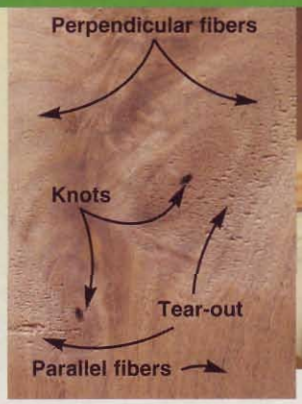
Crosscuts, on the other hand, tear across fiber walls, which introduces more stress on the material. Think of slamming an axe into the side of a log: The blade smashes through a few layers of fibers, then stops.

Making a clean crosscut in a board requires a cutter sharp enough to slice fiber walls rather than smash through. Even sharp cutters bend the fibers ahead of and surrounding the cut. Sometimes, the wood tears before the blade cuts through.

The problem:
Wood fibers around the cut tear out.
The solutions:
- Keep blades and bits sharp.
- Use a slow feed rate to reduce pressure placed on the fibers.
- Make multiple shallow passes.
- Use zero-clearance tablesaw inserts and back workpieces with scrapwood backer boards. These support the wood fibers where the cutter exits the workpiece to reduce the likelihood of tear-out.

READ GRAIN TO SAVE FACE WHEN SURFACING

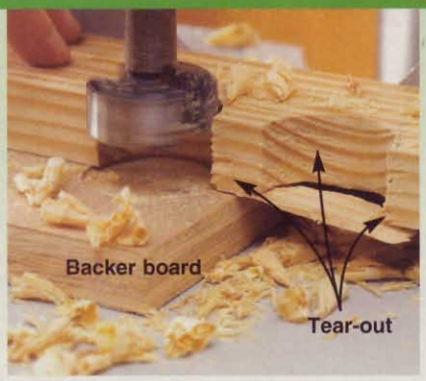
Unfortunately, not all cuts fall neatly parallel or perpendicular to the wood fibers. That's because we often cut wood at angles, and because the fibers in wood run in all sorts of directions around knots as well as in burls or other areas of abnormal growth. These areas often produce inconsistent tear-out—usually a minor problem on board edges, but a big headache on a the face of a board. Tear-out on the face can ruin figured boards, such as those with curly or birds-eye patterns.



The problem:
A jointer or planer produces a smooth surface on straight-grain portions of a board, but tear-out on others.
The solutions:
- Take extremely light cuts to minimize tearing pressure on the wood fibers.
- Keep jointer and planer knives sharp.
- Feed with the grain (see inset).
- *Sand figured boards to thickness using* a horizontal drum sander if you have access to one.
- Dampen the wood surface before planing to increase fiber flexibility.

EXCITING SOLUTIONS TO BORING PROBLEMS

Boring holes in wood presents even more problems because the spinning cutting edge of a drill bit cuts through fibers running in multiple directions. And a bit produces a great deal of pressure on the wood fibers ahead of and around it. This can cause tear-out where the bit enters the wood, in the walls of the hole, and, especially, where the bit exits.



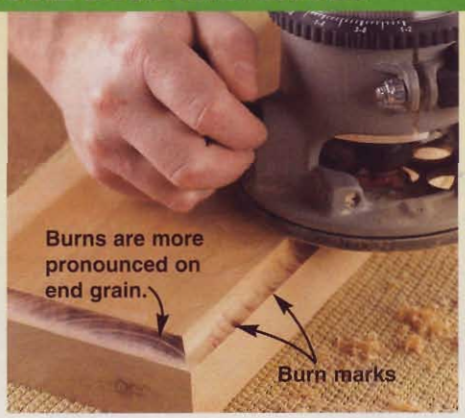
The problem:
Drilling produces holes with rough edges and tear-out where the bit exits the wood.
The solutions:
- Don't feed the bit into the wood too quickly or with too much force, or fibers will tear ahead of the cutting edge.
- Spin large-diameter bits more slowly to ensure adequate time for the bit to slice the wood and eject waste, and to prevent overheating. (Find a free drill-press speed chart in the "Woodworking Basics" section at woodmagazine.com.)
- Use backer boards to prevent tear-out.
- Keep drill bits sharp and clean.

EXTRACTIVES AND RESINS PRODUCE MORE BURNING ISSUES

As trees convert sapwood to heartwood, the fiber walls take on substances called extractives. They color wood and can increase rot resistance, but they pose machining challenges.

Extractives can be very abrasive. In some woods, the extractives quickly dull cutters and lead to excessive heat buildup. That's why even softwoods that contain loads of extractives, such as cedar, for example, can be "hard" on cutting edges.

Fiber walls also can contain resins that burn from router bit and saw blade friction. These resins produce dark brown or black marks on the wood that often have to be sanded or scraped away by hand after machining. Resins build up on cutters, too, becoming pitch. Such woods as cherry, pine, and maple are exceptionally resinous.



The problem:
Routing or cutting leaves burn marks on the wood.
The solutions:
- Keep blades and bits sharp, and free of pitch buildup.
- Reduce heat by making multiple shallow passes.
- Increase feed rate.
- Decrease speed of router motor.

Up next: Staining and finishing strategies

In the October issue, we'll examine how wood's anatomy influences the success you'll have with the final stages of project production: staining and finishing.

Written by **David Stone**
Illustration: **Eric Flynn**

Critical Questions about Workshop Wiring

See if your shop has the power it needs for the woodworking you want to do.

Power tools have big appetites for electricity, and unless you built your shop from scratch, you've likely tripped circuit breakers trying to feed them.

A properly wired shop offers the only way to ensure an adequate food supply. So how do you determine your shop-wiring needs? Take the time to answer the following questions, and you'll be well on your way.

Note: *Unless you are skilled at electrical work and familiar with local codes, leave wiring jobs to a professional. Use the information gathered here to guide your conversations with an electrician.*

Q How much power do my tools require?

A Tools feed on amps. The nameplate, located on the tool body or motor housing, *above right*, indicates just how many the tool will need (draw) under full load. The chart, *right*, shows average ranges for some common tools.

Jot down your major power tools' requirements, and keep the list for later planning. Note any tools that can be wired to run on 240 volts instead of 120. (The nameplate indicates this, as well.)

Q Is my electrical service adequate?

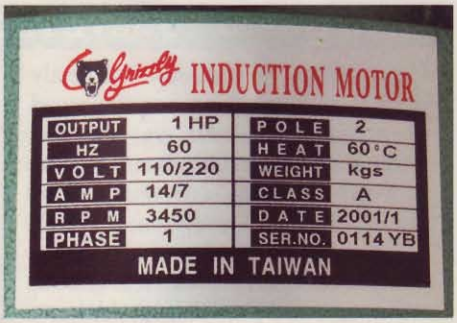
A Look at the number printed on the main breaker in your service panel to determine the total amperage available to your home from the power supply line. This tells you the maximum amperage that all electrical circuits can draw simultaneously.

Most homes built in the past 40 years are equipped with 100- or 200-amp service, which should provide ample power to run your household and, in many cases, a shop. Plus, the service panel may have unused circuits available for your shop wiring needs.

Even if you have space for extra circuits, consider running a separate feeder to a subpanel in your shop. Advantages include not having to share circuits with the house, snaking just one large cable instead of multiple smaller ones, and being able to shut off shop power when it's not in use.

Adding a subpanel also allows shorter wiring runs in the shop, which decrease power loss and heat buildup. But, a subpanel won't increase your total capacity. In other words, if you have 200-amp service, and you split off 80 amps to a subpanel, you don't have 280 amps available.

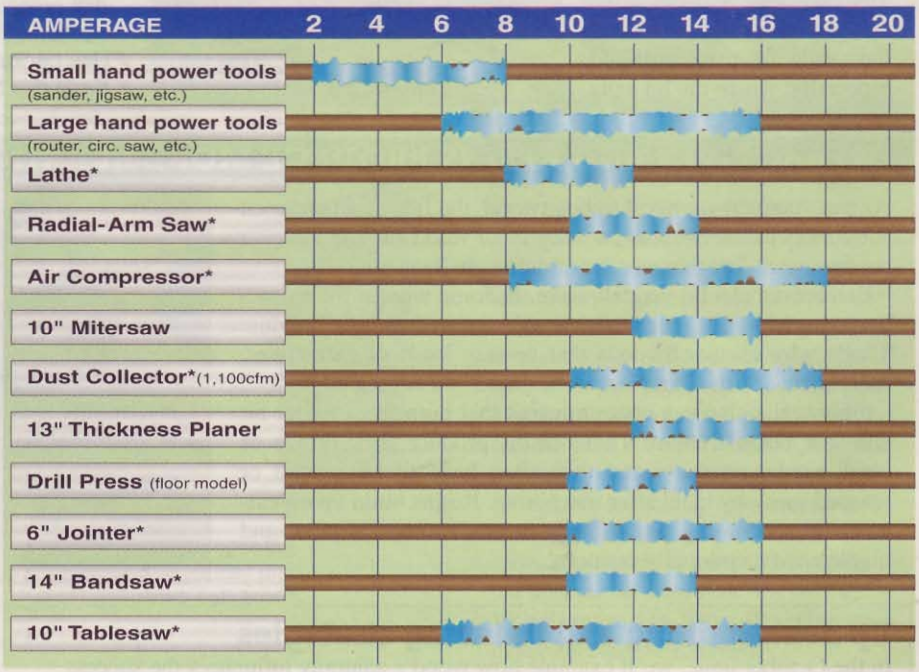
If your home was built before the 1950s and hasn't been electrically updated, you may have only 60-amp service. If that's the case, if you still have a fuse box, or if you frequently trip breakers, you need increased service and a new panel.



Nameplates bear loads of information about a motor. To figure wiring needs, look for "volts" and "amps." The dual readings on this motor show it can be wired to run on either voltage.

Be aware, too, that if your shop is located in a garage or unfinished basement, electrical codes will likely require Ground-Fault Circuit Interrupter (GFCI) protection on all general-use outlets. These devices detect current leaks and shut down power instantly if a short occurs. GFCI outlets protect specific areas within a circuit, while a GFCI breaker serves the entire circuit.

AVERAGE TOOL AMPERAGE RANGE



Ratings represent amperage draw at 120 volts.
* For tools wired at 240 volts, cut the amperage rating in half.

Outlets and wire must match to ensure safe power transmission. This 20-amp outlet (as indicated by the horizontal slots) must be paired with 12-gauge or heavier wire.

Find your amp needs

To determine how much capacity your shop needs, first find your highest-amp-draw tool (often a tablesaw or dust collector), and multiply the amperage by 125 percent

Highest amps × 1.25 = (A) _____

Now, total the amperage of the highest draw tools that run simultaneously, such as a tablesaw and dust collector, router and shop vac, etc.

Simultaneous tool amps = (B) _____

Total the amp draw of all other loads that run continuously, such as lighting, heat/air conditioning, air filter, radio, etc. (*If amps unknown, such as with lights, divide watts by voltage to get amps.*)

Continuous-draw amps = (C) _____

MINIMUM AMPS REQUIRED FOR SHOP (A+B+C) = _____

For example:

Highest draw (A):	
(18-amp tablesaw) × 1.25	22.5
Highest simultaneous (B):	
(18-amp saw+11-amp dust coll.)	29
Continuous (C):	
(lights, heat, television, air filter)	24
Minimum Amps Required (A+B+C) =	75.5

Powering this shop adequately requires 80-amps of extra capacity in the existing service panel, or an 80-amp subpanel.

Q How do I size my circuits and subpanel ?

A Start by examining the list of your tools' amperage needs you jotted down earlier. Most small portable power tools can operate with 15 amps, but big routers and circular saws often require more. Plus, electrical codes dictate that the total load on a circuit can't exceed 80 percent of its capacity—that's 16 amps on a 20-amp circuit. Dedicate two 20-amp circuits for benchtop and portable-tool outlets.

Larger 120-volt machines (tablesaw, planer, dust-collector, etc.) require a 20- or 30-amp circuit. If you run two machines at once, such as your tablesaw and dust collector, then each needs a separate circuit.

This is where the ability to rewire to 240 volts is a bonus. Remember, power equals voltage multiplied by current. Because the power delivered by a motor doesn't change, the current it draws at 240 volts is half what it would require at 120 volts. Convert your 18-amp tablesaw and 14-amp dust-collector, and they'll consume 16 total amps instead of 32. That means both could run on one 20-amp, 240-volt circuit.

Always keep lighting on a separate circuit. That way, if a tool trips a breaker, you won't be left in the dark. You might get by with a 15-amp circuit for lights, but using a 20-amp circuit adds extra capacity.

Knowing this information, you can size your shop's total service requirement using the guidelines at *left*. As you can see, you don't need to add up the amp requirements of every tool. But don't forget such non-tool items as lights, heaters, and chargers.

If you add up all of your circuits, you'll likely end up with a total higher than the subpanel rating. Don't worry. Having one 30-amp and five 20-amp circuits (130 amps total) in an 80-amp subpanel is common.

Q What type and size of wiring will I need?

A The most common wiring for residential use is non-metallic sheathed cable, called type NM-B, shown in the photos, *below*. If you run your wiring inside walls, this is your likely choice. In surface-mounted conduit, individual insulated wires are acceptable. Underground feeder cable (type UF-B) looks similar, and gets used in damp areas or for underground burial.

In addition to the right type, you need the correct size, or American wire gauge (AWG), which is dictated by the amperage the wire must carry. The larger the wire number, the smaller the gauge. You can always use heavier-gauge wire than specified, but never use lighter gauge. It may get hot enough to melt the insulation and short out. Color coding used by most manufacturers these days simplifies identification.

Q Will my tools run better on 240 volts?

A Contrary to common misconception, running tool motors on 240 volts instead of 120 doesn't make the motor more powerful. A motor's construction limits how much power it can take in, which is the amp rating on the nameplate.

This motor generates 2 hp at 240 volts, and 1.5hp at 120 volts. The nameplate lists this power increase, but you can tell also by looking at the amp ratings: The 12.8 amps drawn at 120 volts would drop to 6.4 amps at 240, so the 8.6-amp reading gives it away.

To understand this better, think in terms of a motor's truest power measure: wattage, which equals amps multiplied by voltage. A motor rated for 14 amps at 110 volts draws 1,680 watts (14×120=1,680). Double the voltage, and the amp need gets cut in half, but output remains the same (7×240=1,680).

You may notice a "power" difference, though, if you've been running your 18-amp tablesaw on a 20-amp circuit. Because this motor, at maximum load, draws almost every amp the circuit can spare, it may slow. Wire the same motor for 240 volts, and at full load it only draws 9 amps of the 20 available.

Also, at least some tools are exceptions to the rules. We discovered a contractor's saw that has a motor with an extra set of windings that only come into play when wired for 240 volts. The horsepower rating on the nameplate, *above*, was our first clue.

Q How do I choose the right extension cord?

A No matter how many outlets your shop contains, you may occasionally need an extension cord. Keep the following rules in mind:

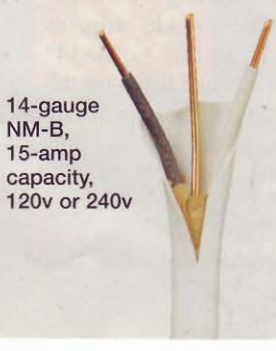
1) The longer the cord, the fewer amps it can handle, and the greater the voltage drop will be across it's length.

2) The lighter the gauge (larger AWG number), the fewer amps the cord can handle.

For example, a 50'-long, 12-gauge cord can handle 15 amps. At 150', though, a 12-gauge cord can't handle more than 10 amps.

The lesson: For shop use, buy only 10- or 12-gauge extension cords that are no longer than necessary for the job.

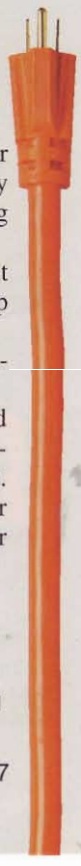
Written by **David Stone**



14-gauge NM-B, 15-amp capacity, 120v or 240v

12-gauge NM-B, 20-amp capacity, 120v or 240v

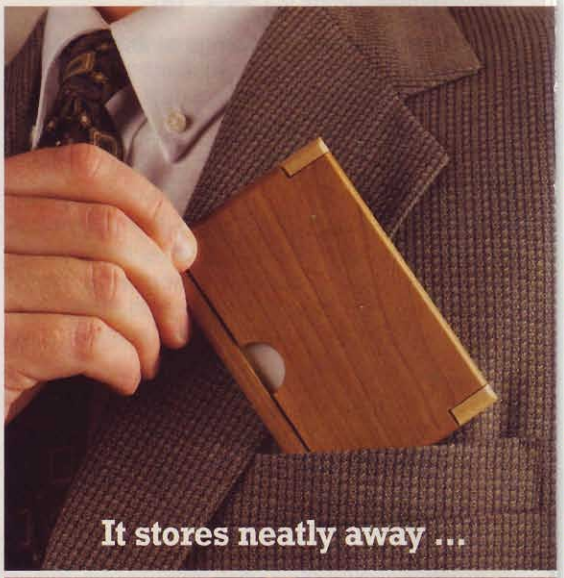
10-gauge NM-B, 30-amp capacity, 120v or 240v



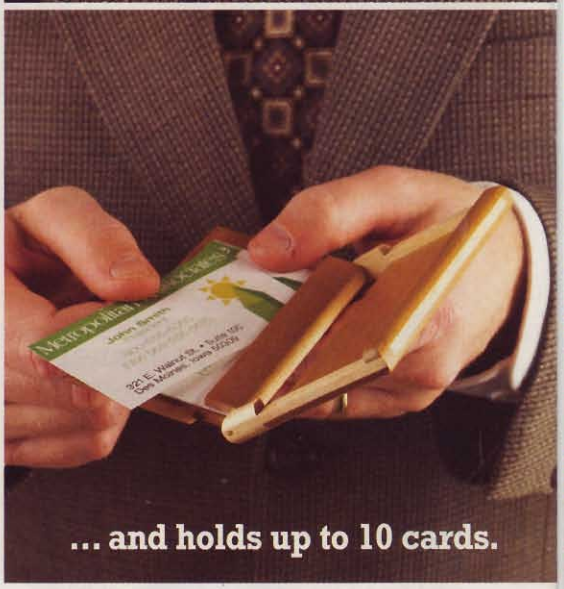
Always use extension cords of proper size and length. Codes stamped into the cord jacket indicate capacities.

holds cards, will travel
business card case

Add the wow factor to handing out your business cards with a classy case that says, "I take my woodworking seriously."



It stores neatly away ...



... and holds up to 10 cards.

Shown in cherry and maple, *top*, and lacewood and wenge, *bottom*, these card cases are closed up and ready to hit the road.

Thanks to its simple pinned hinge, this case props itself open for displaying cards on a desktop, and also folds shut into a slim tote for traveling in a suit-coat pocket. Completed, it measures just ⅜×2¾×4¼" and holds about 10 cards. We'll show you how to make the wenge and lacewood card case, but you can use any combination of contrasting wood species, or even a single species.

Note: *For the safe cutting of the small parts in this project, install a zero-clearance insert in your tablesaw. The sidebar,* right, *shows methods for cutting small pieces that you can adapt to any project.*

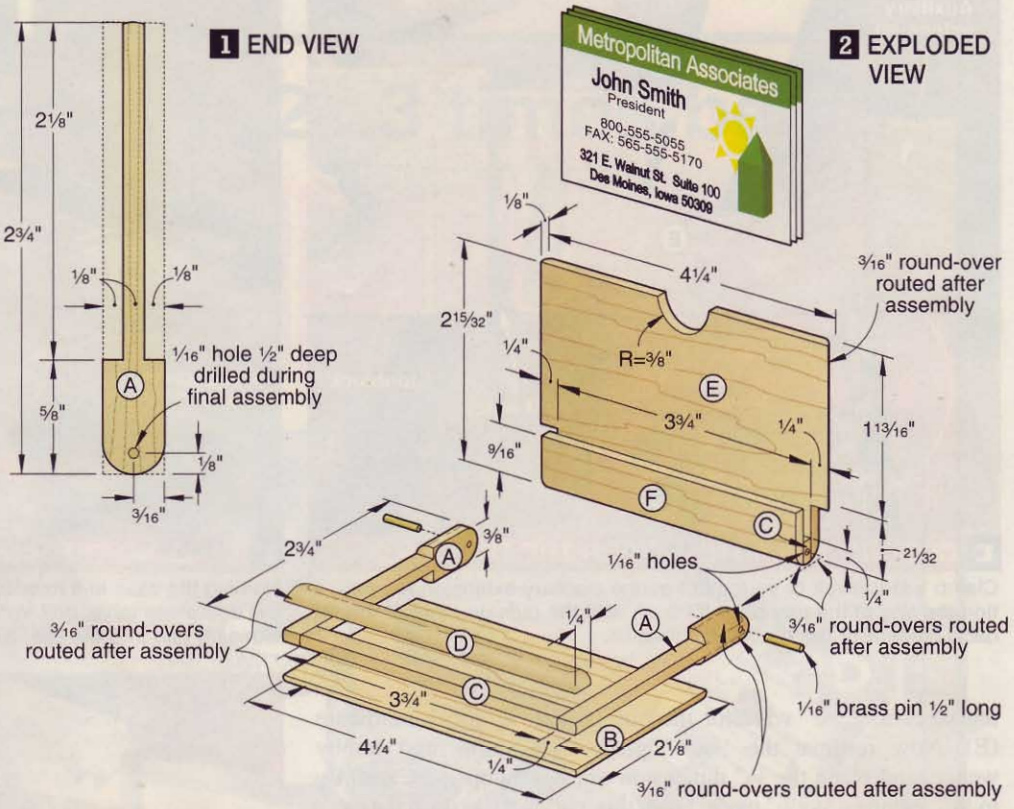
Cut the parts, and assemble the case halves

1 To make the sides (A), rip a 7/16"-wide 14"-long strip from the edge of a ¾"-thick piece of wenge. Then cut a ¾×2¾×16" piece of scrap for a carrier board. Now plane both the wenge and carrier board to ⅜" thick. Set the carrier board aside, and from the resulting ⅜×¾×14" piece of wenge, rip a ¼"-wide strip, as shown in **Photo A**. From this ¼×⅜×14" strip, cut the sides to the size listed on the **Materials List**. Set aside the remaining piece of wenge for the fillers (C).

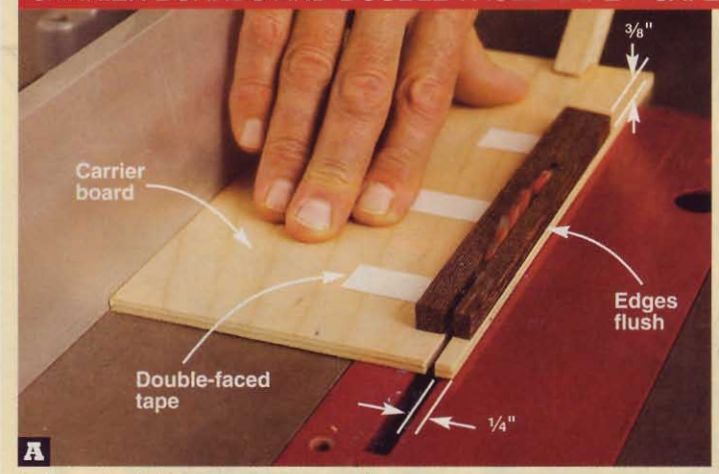
2 Retrieve the ⅜"-thick carrier board, and adhere the sides (A) to its ends, as

shown in **Photo B**. Raise the ⅛"-kerf blade in your tablesaw to 2⅛". Then attach an auxiliary fence to the rip fence, and position it so the blade just grazes its surface. Begin forming the ⅛"-deep 2⅛"-long recesses shown on **Drawing 1** by making the two cuts shown in **Photo C** in the sidebar, *below*. Now reposition the fence so the left face of the blade is flush with the left face of the scrap, and make two more cuts. Remove the sides from the scrap.

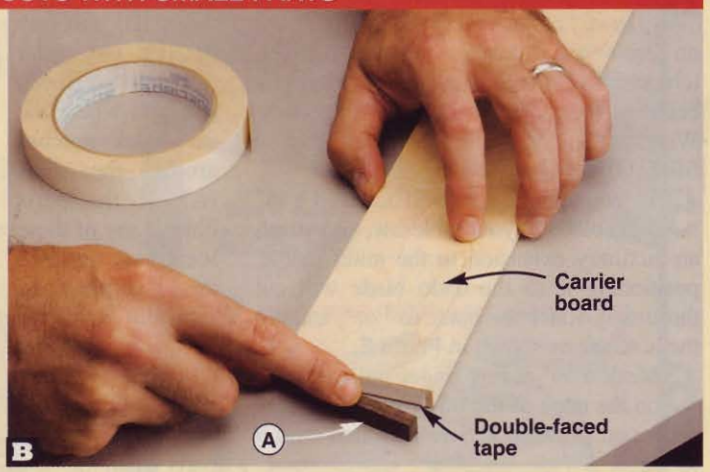
3 From a ¾×3¼×10" piece of lacewood, resaw and plane a piece to ⅛" thick. From this ⅛×3¼×10" piece, crosscut two 4¼"-long blanks. From one blank, rip a 9⁄16"-wide strip for the tray lip (F), as shown in **Photo D**. Then rip the remaining piece to 2⅛" wide for the cover (B). From the other blank, rip a ¼"-wide strip for the tray filler (D). Then rip the remain-



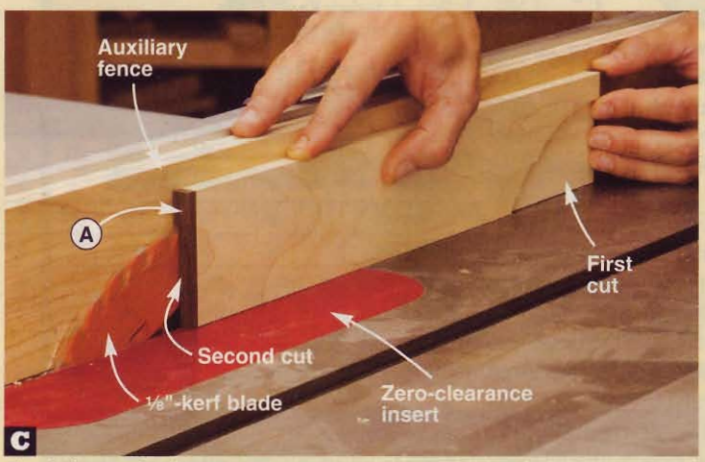
CARRIER BOARDS AND DOUBLE-FACED TAPE = SAFE CUTS WITH SMALL PARTS



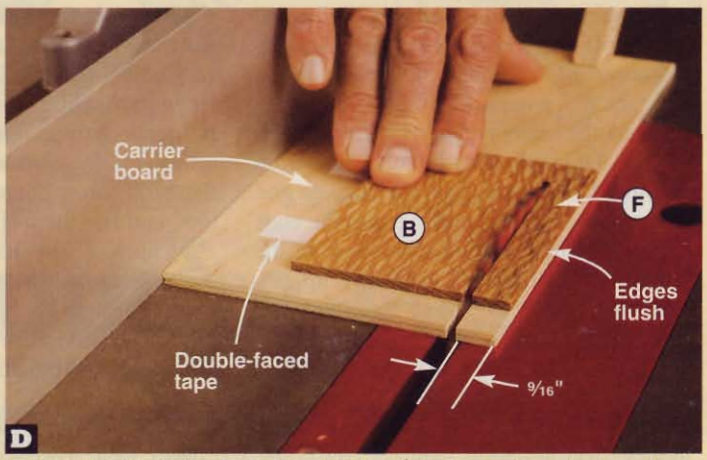
Adhere the ⅜×¾" wenge strip to a ¼" plywood carrier board with double-faced tape, keeping the edges flush. Rip off a ¼"-wide strip.



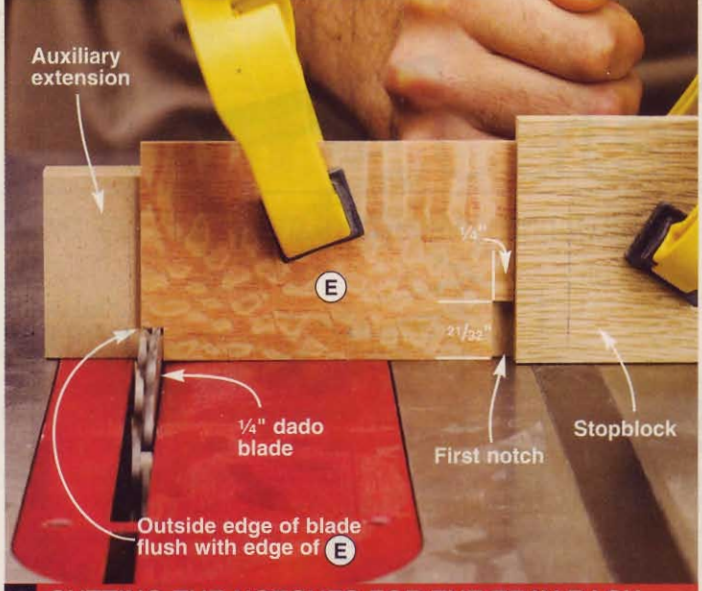
Use double-faced tape to adhere the sides (A) to the ends of a carrier board. Make sure the parts and carrier are flush all around.



Feed the carrier board with the sides (A) into the blade just past its center. Then pull the carrier back, and repeat at the other end.



Adhere the blank for parts B and F to a ¼" plywood carrier board, keeping their edges flush. Rip off a 9⁄16"-wide strip for part F.



E CUTTING THE NOTCHES FOR THE TRAY BACK

Clamp a stopblock to your miter-gauge auxiliary extension to position the end of the tray back (E) flush with the outside edge of the 1/4" dado blade. Cut the 21/32"-deep notches.

F DRILLING THE HINGE PIN HOLES

Holding the case in a handscrew clamp to keep it perpendicular to the drill-press table, drill 1/16" holes 1/2" deep through the ends of the sides (A) and into the filler (C).

ing piece to 2 15/32" wide for the tray back (E). Now retrieve the 1/4×3/8" piece of wenge, and plane the 3/8" dimension down to 1/8", leaving a 1/8×1/4" piece. From this, cut the fillers (C) to size.

4 Glue and clamp the sides (A) and one filler (C) to the cover (B), where shown on **Drawing 2**. To keep the sides parallel, temporarily insert the other filler (C) between the sides at their pivoting ends. With the glue dry, glue and clamp the tray filler (D) in place, where shown.

5 To notch the tray back (E), install a 1/4" dado blade in your tablesaw, and attach an auxiliary extension to the miter gauge, positioning it so the dado blade will cut through it. Raise the blade to 21/32", and cut the notches, as shown in **Photo E**.

6 Mark a 3/8"-radius finger pull centered on the edge of the tray back (E), where shown on **Drawing 2**. Scrollsaw and sand it to shape.

7 Retrieve the piece of lacewood previously cut for the tray lip (F), and cut it to finished length, trimming an equal amount off each end. Now glue and clamp the second filler (C) and the tray lip to the tray back (E), where shown on **Drawing 2**.

8 Mark the centers of the 1/16" holes on the sides (A) with an awl, where shown on **Drawing 1**. Assemble the case halves and clamp them together, making sure the ends of the sides are flush with the edges of the filler (C), tray back (E), and tray lip (F). Drill the holes, as shown in **Photo F**. Remove the clamps.

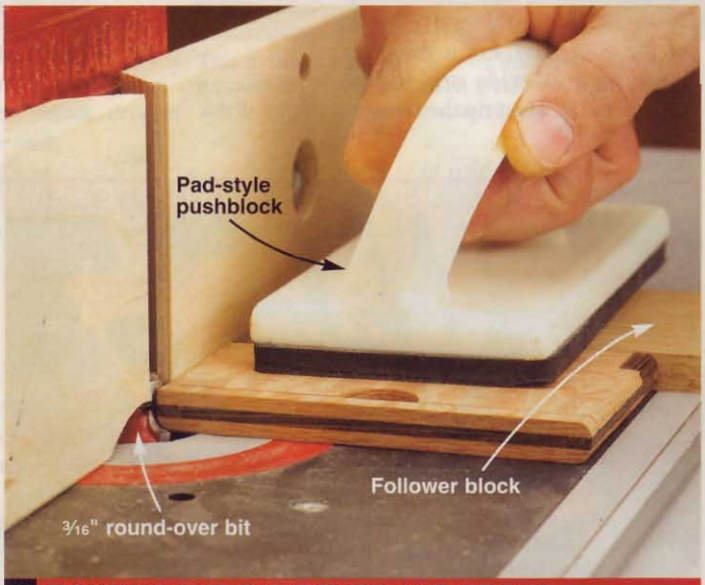
Fine-tune and finish

1 Cut two 5/8"-long hinge pins from 1/16" brass rod, and press them into the holes, leaving 1/8" protruding. (We found brass rod at local hardware stores and hobby shops.) Carefully try to open the case, checking the clearance between the cover (B) and tray lip (F), tray filler (D) and tray back (E), and where the tray back notches around the sides (A). If the parts bind at any of these locations, remove the hinge pins, and carefully bevel the edges with a file. To keep from widening the gaps you see between parts when the case is closed, form the bevels only on the parts' inside edges.

2 Reinsert the brass hinge pins, check the clearances, and make any necessary adjustments. When satisfied with the fit, withdraw the hinge pins, dip their ends in quick-setting epoxy, and push them into the holes. After the epoxy cures, clip the protruding hinge pins with wire cutters, and file them flush.

3 Chuck a 3/16" round-over bit in your table-mounted router, and rout the case ends and edges, as shown in **Photo G**.

4 Finish-sand the outside of the case, and apply a clear finish. (We used three coats of Danish oil, buffing with an ultrafine Scotch-Brite pad after the first two coats.) Now load your case with business cards, and head off to your next meeting.



G ROUTING THE CASE ENDS AND EDGES

Positioning the fence flush with the bit's pilot bearing, first rout the case ends, then the front and back edges. For safety, use a pad-style pushblock. To eliminate chipping, use a follower block.

Written by **Jan Svec**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**

Materials List

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A* sides	1/4"	3/8"	2 3/4"	W	2
B* cover	1/8"	2 1/8"	4 1/4"	L	1
C* fillers	1/8"	1/4"	3 3/4"	W	2
D* tray filler	1/8"	1/4"	4 1/4"	L	1
E* tray back	1/8"	2 15/32"	4 1/4"	L	1
F* tray lip	1/8"	9/16"	3 3/4"	L	1

*Parts initially cut oversize. See the instructions.

Materials key: W–wenge, L–lacewood.

Supplies: 1/16"-diameter brass rod, double-faced tape, quick-setting epoxy.

Blades and bits: Stack dado set; 3/16" round-over router bit.

build a uniting bridge

Crown your cabinets with a matching shelf.

Spanning the space between the two tower cabinets, the bridge ties the separate pieces together into a single unit. When using a TV significantly shorter than the maximum height the entertainment center accepts, you can fill the space between the top of the TV and the bridge by adding a hanging shelf. See *page 104*.

Cut and assemble the parts

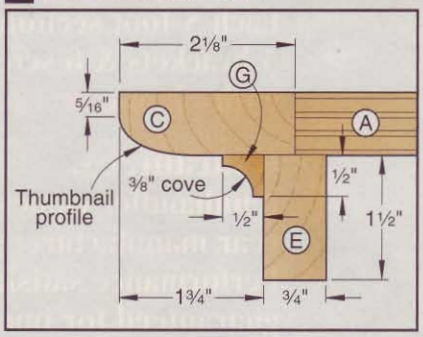
1 Cut the top panel (A) to the size listed in the **Materials List**. Then cut the front band (B) and side bands (C) about ½" longer than listed. Miter-cut the bands to fit the panel front and sides, trimming the rear ends of the side bands flush with the rear edge of the panel. Glue and clamp the bands to the panel, where shown on **Drawing 1**. Sand the bands flush with the panel. Now rout the thumbnail profile shown on Drawing 9 in the "Tower Cabinet" article on *page 51* along the bottom edges of the bands, where shown on **Drawings 1** and **2**. Finish-sand the assembly.

2 Cut the front and rear skirts (D) and the side skirts (E) about ½" longer than listed. Then miter-cut them to length. Glue and clamp together the skirt frame (D/E), checking to make certain it is square and flat. When the glue dries, finish-sand the skirt frame, and glue and clamp it to the panel assembly (A/B/C), flush at the back and centered side-to-side.

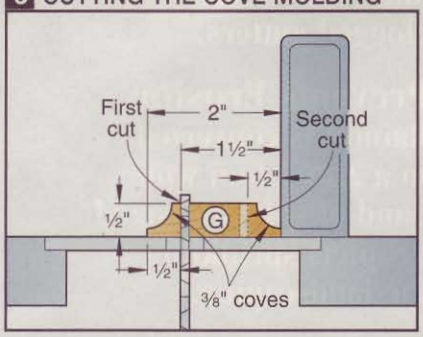
3 To make the front cove (F) and side coves (G), cut a ¾×2×64" blank, and plane it to ½" thick. Then install a ⅜" cove bit in your table-mounted router, and rout the edges of the blank. Rip cove molding from the blank, where shown on **Drawing 3**, cutting both cove strips from the blank to the *left* of the blade. Now miter-cut the coves to fit the skirt front and sides, where shown on **Drawings 1** and **2**, trimming the ends of the side coves flush with the back face of the rear skirt. Finish-sand the coves, and glue and clamp them in place.

Continued on page 104

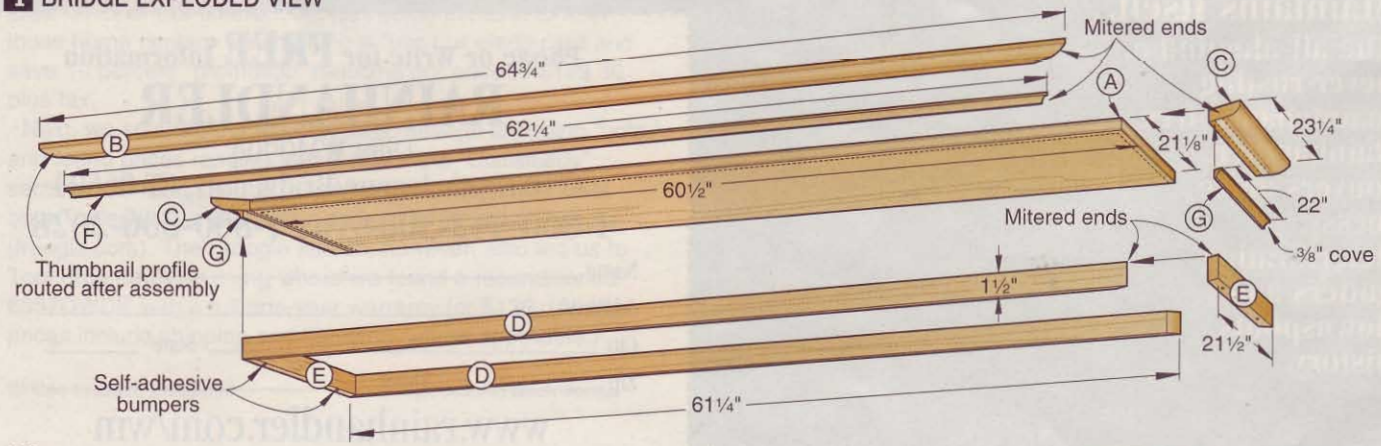
2 SIDE SECTION VIEW



3 CUTTING THE COVE MOLDING



1 BRIDGE EXPLODED VIEW

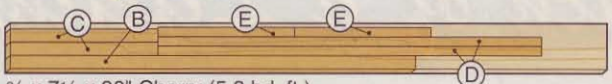


Apply the finish

1 Touch up the finish-sanding, where needed. Apply a clear finish. [We sprayed two coats of water-based satin polyurethane on the entire project, and a third coat on the top surface of the top (A/B/C), sanding with 220-grit sandpaper between coats.]

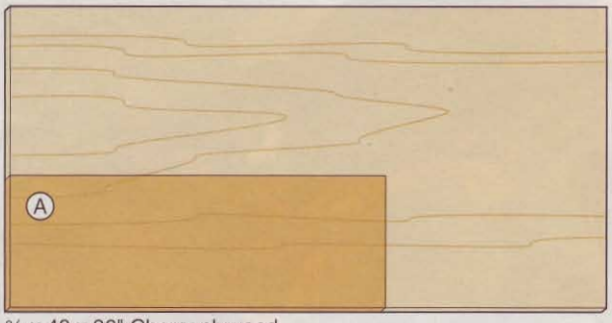
2 When the finish dries, install self-adhesive bumpers to the bottom edge of the side skirts (E), where shown on **Drawing 1.**

Cutting Diagram



¾ x 7¼ x 96" Cherry (5.3 bd. ft.)

¾ x 3½ x 96" Cherry (2.7 bd. ft.)
*Plane or resaw to the thickness listed in the Materials List.



¾ x 48 x 96" Cherry plywood

Materials List

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A top panel	¾"	21⅛"	60½"	CP	1
B* front band	¾"	2⅛"	64¾"	C	1
C* side bands	¾"	2⅛"	23¼"	C	2
D* front and rear skirts	¾"	1½"	61¼"	C	2
E* side skirts	¾"	1½"	21½"	C	2
F* front cove	½"	½"	62¼"	C	1
G* side coves	½"	½"	22"	C	2

*Parts initially cut oversize. See the instructions.

Materials key: CP–cherry plywood, C–cherry.

Blades and bits: ⅜" cove and thumbnail table-edge router bits.

Sources

Hardware. 10mm-diameter by 3mm-thick self-adhesive bumper pads no. 00S20.02, $4.80 (package of 43). Call Lee Valley 800/871-8158, or go to leevalley.com.

Thumbnail bit. ½"-shank thumbnail table-edge bit no. 8560, $31. Call MLCS 800/533-9298, or go to mlcswoodworking.com.

lofty storage

Add this accommodating shelf to the bridge, and keep your electronic components, CDs, DVDs, or videos at arm's reach.

By filling the void between your TV and the bridge that spans the entertainment center towers, this handy shelf gives your center a custom-fit look. Simply size the shelf opening to suit the height of your TV or the items you wish to store on it.

Plan your hanging shelf

Note: To determine the length of the sides (D) and side trim (E) for the hanging shelf, first build all the entertainment center components, and set them up, including the TV, in the final configuration.

1 To make sure you have enough clearance for a shelf, measure from the top of your TV to the bottom of the bridge front skirt. You need an 8¼" minimum clearance to add a shelf with a 5" opening. (This size opening will accommodate most VCRs and DVD players.)

2 To determine the maximum shelf opening that will fit your space, subtract 3¼" from the measurement you just made, and note this dimension. (The 3¼" accounts for the combined thickness of the shelf panel and its supporting skirt, and 1" clearance between the TV and the bridge skirt.)

Cut and assemble the parts

1 Cut the shelf panel (A) to the size listed on the **Materials List.** Then, as you did for the bridge, miter-cut the front band (B) and side bands (C) to fit, and glue and clamp the bands to the panel. Rout the thumbnail profile along the bands. Finish-sand the assembly

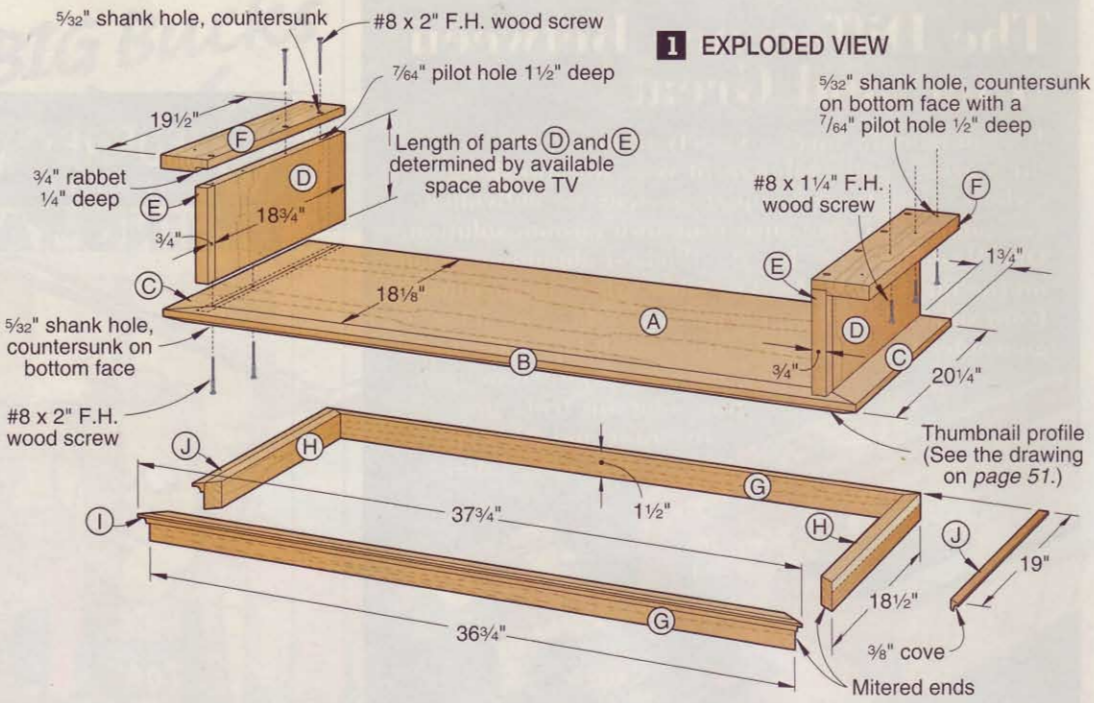
2 To determine the length for the sides (D) and side trim (E), add 1" to the shelf-opening dimension you noted. Then cut the parts to size. Glue and clamp the trim to the sides, where shown on **Drawing 1.** Finish-sand the

Continued on page 106

parts. Now glue and screw the side/trim assemblies (D/E) to the shelf panel (A), where dimensioned on **Drawing 1**.

3 Cut the cleats (F) to size. Then cut rabbets where shown. Drill holes through the cleats for attaching the shelf to the bridge, and countersink them on the bottom (rabbeted) faces. Now finish-sand the cleats, and glue and clamp them to the sides (D). Drill mounting holes, and screw the cleats in place.

4 Following the same procedures you used when making the bridge, miter-cut the front and rear skirts (G) and side skirts (H) to size. Then glue and clamp the parts into a frame. After the glue dries, glue and clamp this assembly to the shelf panel (A). Rout and miter-cut the front cove (I), and side coves (J) to size, and glue and clamp them in place. Finish-sand the parts.



Finish and hang the shelf

1 Touch up the finish-sanding where needed. Apply a clear finish as before.

2 Lay the bridge upside down on your workbench. Position the hanging shelf on it, centered side-to-side with the side trim (E) against the back of the front skirt (G). Using the mounting holes in the cleats (F) as guides, drill pilot holes into the bridge, and drive the screws.

Set up the center

1 Determine the location for your entertainment center. You'll need about 96" of wall space and a power outlet within or near this space. Position the TV stand against the wall, or if your TV is deeper than the stand, pull it away from the wall so

MOBILITY MADE EASY
DRAGGING A LITTLE LATELY?

MOVING YOUR MACHINES CAN BE A REAL DRAG. LITERALLY!
Dragging machines around your workshop is hard on the machine, not to mention your back. The HTC-2000 adjustable mobile base is *the* solution. Easy foot action, 400 lb. capacity, expands from 12" x 12" to 36" x 36" or 20" x 52" rectangular. Stop dragging and start rolling today!
For your nearest dealer and FREE catalog, call toll-free 1-800-624-2027
Circle No. 1961
© HTC Products, Inc. 2004

Refinish Your Future.

Own your own business.
Let your passion for furniture lead you into a new business with a Furniture Medic franchise. We're a complete on-site repair and restoration-refinishing business servicing homes and companies as well as handling moving and insurance claims. We offer extensive training and support with a low initial investment and manageable overhead. Financing is available to qualified candidates and franchises are offered nationwide. Call today to brush up on the details.
FURNITURE MEDIC
www.furnituremedicfranchise.com 1•800•RUN YOURS
Circle No. 895

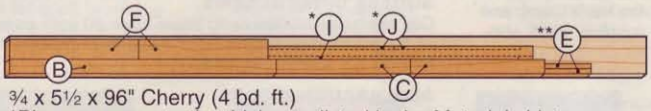
the front of the TV and the stand will be flush. Place the TV on the stand, and plug it in. Flank the stand with the tower cabinets, positioning the cabinet that will house your electronic components away from the wall, with its back turned toward the TV and the other cabinet back against the wall.

2 Place your electronic components on the adjustable and fixed shelves of the component tower. Reaching through the back cutout from the rear, connect the signal input wire or wires (antenna, cable, or satellite). Then make the component-to-component connections. Now run the power cord, TV cables, and speaker cables to their destinations. (To power the components, we placed a multi-outlet power strip at the back of the fixed shelf so only one power cord runs from the component cabinet to the wall outlet.)

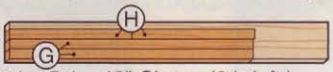
3 Test the components. When everything works properly, position the component cabinet with its back against the wall. Rest the bridge on the two side cabinets with the back of the rear skirt (D) flush with the backs of the tower cabinets and centered side-to-side. Now go make some popcorn, and prepare to be entertained.

Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**

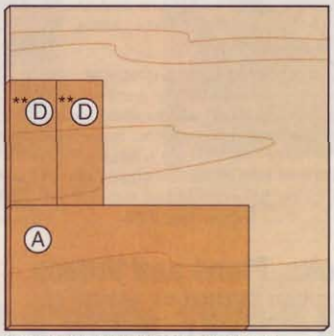
Cutting Diagram



¾ x 5½ x 96" Cherry (4 bd. ft.)
*Plane or resaw to the thickness listed in the Materials List.
** Length of parts determined by measurement. See instructions.



¾ x 5½ x 48" Cherry (2 bd. ft.)



¾ x 48 x 48" Cherry plywood

Materials List

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A shelf panel	¾"	18⅛"	36"	CP	1
B front band	¾"	2⅛"	40¼"	C	1
C side bands	¾"	2⅛"	20¼"	C	2
D sides	¾"	18¾"	†	CP	2
E side trim	¾"	¾"	†	C	2
F cleats	¾"	3"	19½"	C	2
G front/rear skirts	¾"	1½"	36¾"	C	2
H side skirts	¾"	1½"	18½"	C	2
I front cove	½"	½"	37¾"	C	1
J side coves	½"	½"	19"	C	2

†Length, which is measured with the grain, varies depending on the size of your TV opening and height of items stored. See the instructions.

Materials key: CP–cherry plywood, C–cherry.

Supplies: #8×1¼" and #8×2" flathead wood screws.

Blades and bits: ⅜" cove and thumbnail table-edge router bits.

KLINGSPOR'S
WOODWORKING SHOP
"Quality Tools and Supplies for the Woodworker"

KLINGSPOR'S
WOODWORKING SHOP
15 Year Anniversary Truck Giveaway
Join us in our celebration as we give one of our special customers something to carry their woodworking projects around in - A BRAND NEW FORD F150!
Come to one of our 4 stores or check the website for full details.

Whether you shop thru our catalog, our website or one of our four retail stores you will find all your woodworking tools and supplies in one convenient location.

1,000'S OF PRODUCTS AVAILABLE ONLINE
1-800-228-0000 • www.woodworkingshop.com
Circle No. 629

IF COST MATTERS . . .

Boring Tools
Moulder Heads
Carbide Cutters
Moulder Steel
Multi-Spurs
Boring Heads
Insert Tooling
Carving Tools
Lathe Tooling
HSS Router Bits

Circle No. 198

The serious craftsperson and industrial woodworker knows that a quality tool **cuts cleaner** and **lasts longer** so they save money and produce a better finished job. When **COST** counts, use the best ------ tools from:

FOREST CITY
Forest City Tool
Call 800-343-8944
Or E-mail: orders@forestcitytool.biz
To request a catalog or place an order.

Quality Woodworking Tools - since 1890— Proudly made in the USA

ask wood

Answers to your questions from letters, e-mails, and WOOD Online®

fyi: *Remove the bit from your router after each use to keep the collet flexible and effective.*

All router bits are NOT created equal

Q: When I shop for a new router bit, the only obvious differences are color and price. What should I look for to evaluate the quality of a particular bit?

—Will High, Salem, Ore.

A: First, Will, look for carbide bits rather than high-speed steel. They cost more, but hold their edge much longer. For the very top of the line, seek out bits labeled as having micrograin carbide. Before buying a particular bit, perform a visual inspection to determine its quality. Check for the points detailed here and in the photos at *right.*

■ **General appearance:** A well-made bit has cutting edges that gleam and displays no gaps where those edges are brazed to the bit body. Be sure the cutting edges are free of tiny chips.

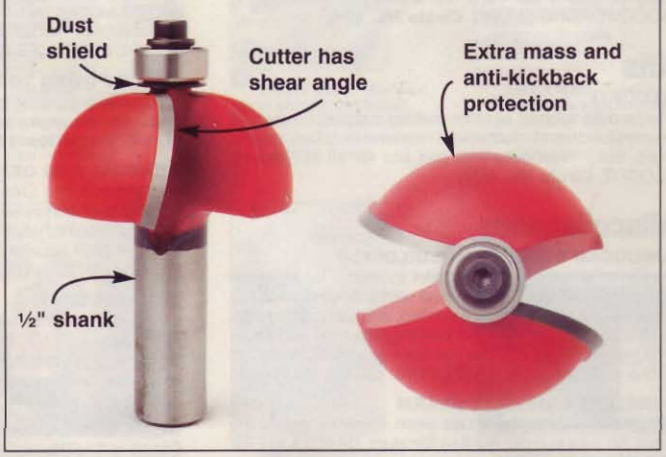
■ **Size:** Choose bits with ½" shanks if your router accepts that size. The extra mass produces a smoother cut and should never break or bend during normal use. Also select bits with plenty of metal behind each cutting edge; besides supporting the edge, this design prevents kickback caused by fast feeding and deep bites.

■ **Sharpness:** Turn a bit against your fingernail and it should easily skim off a shaving. If not, it *hasn't been sharpened* properly and won't give the results you want.

■ **Dust protection:** Bits with pilot bearings perform better and last longer when they include a dust shield between the bearing and the bit body. The shield helps to keep the bearing clean and turning smoothly.

■ **Configuration:** Bits with two cutting edges surpass single-edge bits in making smooth cuts. Also flutes set at a slight angle to the shaft, as shown in the photo *above,* slice wood fibers instead of chopping them, which generally gives better results.

WHAT TO LOOK FOR IN A HIGH-QUALITY BIT



Contractor-style tablesaws vs. cabinet and hybrid

Q: I'm trying to decide whether to buy a contractor-style tablesaw, a cabinet saw, or one of the new hybrids. How should I compare the three types?

—Don Frame, Rosemount, Minn.

A: In general, Don, you need to decide how much you're willing to pay for greater power and heavier components found in a cabinet saw. Get your hands on a few models and make test cuts while keeping these differences in mind:

■ **Power:** The standard cabinet saw has a 220-volt, 3-hp motor, and some models offer 4 or even 5 hp. That kind of power *makes it easy to rip thick, dense stock.* Contractor saws run on 110 volts and typically have 1 to 1½ hp, so they might bog down during heavy-duty cutting. Hybrids also connect to 110-volt circuits and carry a 1¾-hp motor.

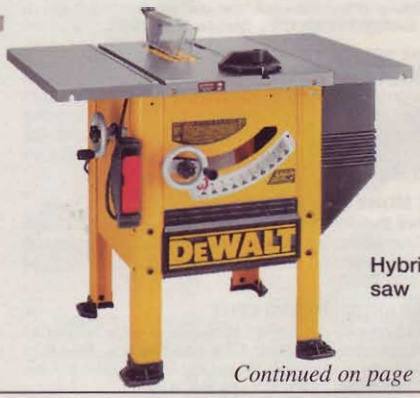
■ **Alignment:** It's easier to align a cabinet saw—you loosen the table bolts and tap it into position—and you don't have to do it very often. Contractor-style and hybrid saws requires more frequent attention, and each time you have to reach inside the saw to adjust the trunnions.

■ **Vibration:** You get solid cast-iron table extension wings with a cabinet saw. Add the overall greater mass of the machine and vibration is virtually eliminated. Most contractor-style saws are much lighter and include stamped-steel wings, resulting in enough vibration to be distracting. Hybrid saws can be outfitted with either steel or cast-iron wings and rank between the other two styles in weight.

■ **Dust collection:** A cabinet saw contains much of the sawdust it produces. A hybrid saw has a dust-collection port, as do most, but not all, contractor-style saws.

Contractor-style saw

Cabinet saw



Hybrid saw

Continued on page 112

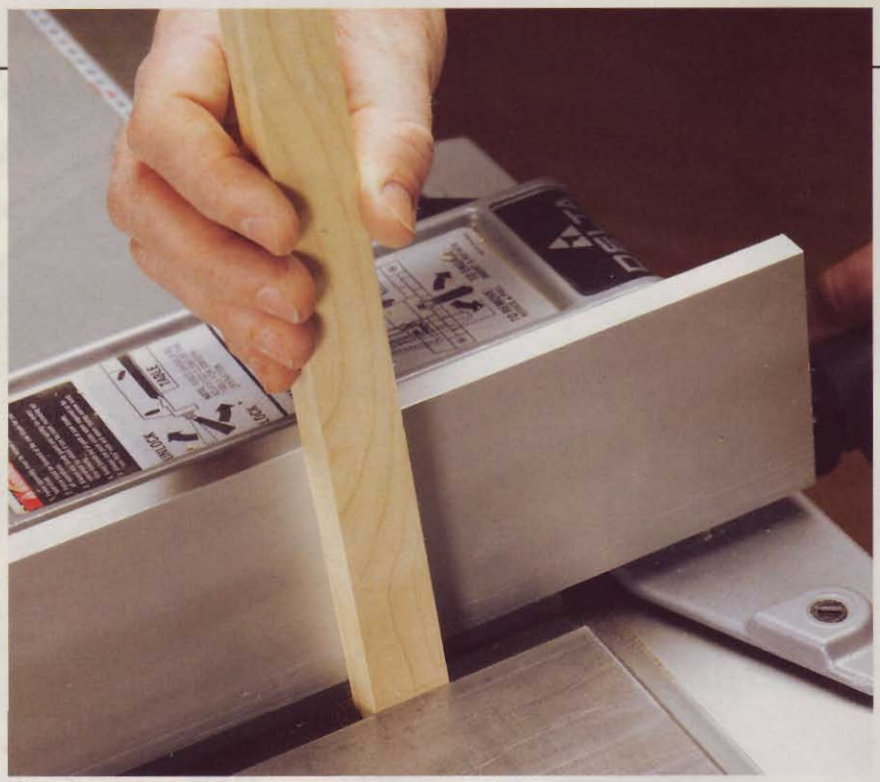
For smooth rip cuts, set the fence parallel to the blade

Q: I always assumed that my tablesaw rip fence should be parallel to the blade, but other woodworkers advise setting it to "toe out" just slightly at the back of the saw. Who's right?

—George Walker, Seattle

A: This debate never ends, George. Those who argue in favor of angling the fence away from the blade are trying to avoid kickback caused by pinching the workpiece, while the "set-it-parallel" folks want the smoothest possible cut. We've tested the two options in the *WOOD®* magazine shop, and we recommend setting the fence parallel to the blade to avoid scoring the workpiece. See issue 152, page 56, for instructions on adjusting your tablesaw, or log on to woodmagazine.com/tablesawtuneup to find the same information as a downloadable seminar.

Once you've achieved a parallel fence setting, use the right accessories to prevent kickback: a sharp, high-quality blade raised so that ¼" shows above the workpiece and a splitter to prevent the sawn workpiece from pinching the blade.



After aligning the miter-gauge slot parallel with the blade, use a scrap of wood to make sure the fence is parallel to the blade. Place the scrap in a miter-gauge slot, slide the fence against it, and lock it in place. Now, move the scrap to the opposite end of the slot; it should contact the fence at that point too.

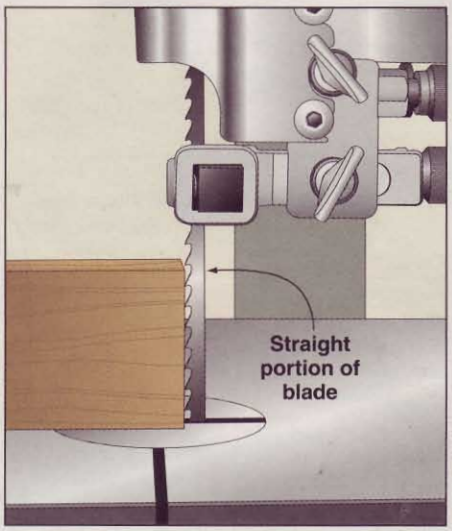
The Next Level...
LAGUNA TOOLS
LAGUNA
LAGUNA
LAGUNA
800.234.1976
www.lagunatools.com
Circle No. 640
Our bandsaw with 12" resaw capacity, cast-iron flywheels, ceramic Laguna Guides, Magnetic starter, 1" blade capacity with and Baldor motor. Call now for your free video, and you will know why this machine is consistently rated # 1..
Our cabinet-maker's saw is larger and heavier. Options such as sliding table and scoring are not afterthoughts. 10" or 12" blade capacity euro-style riving knife, steel extension table and Baldor motor. Call now for your free video.

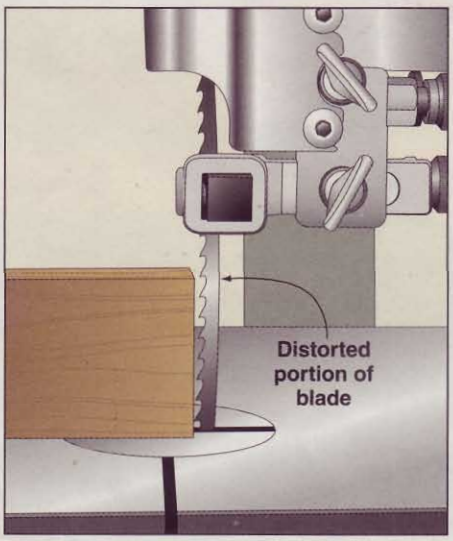
Flawed blade causes unreliable bandsaw cut

Q: When I make a cut with my bandsaw, the blade drifts forward and backward. At any given moment, the teeth might or might not be in contact with the workpiece. The wheels are co-planar with new tires, so what can I do to fix this problem?

—Greg Marble, Oakfield, N.Y.

A: Look to the blade for the problem, Greg. Either a poor welding job distorted the blade, it was bent during use, or the steel warped during manufacturing. In the first case, an expert might be able to fix the problem by cutting and rewelding the blade. If that doesn't help, your best bet is to buy a good quality replacement.





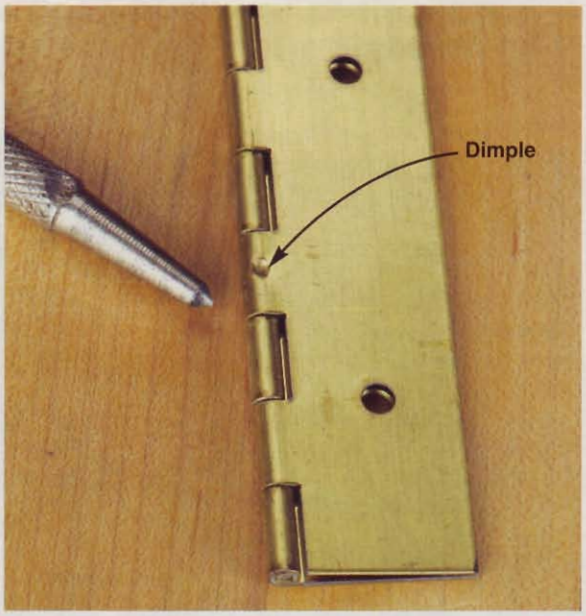
A deformed bandsaw blade can't stay perpendicular to the table all the time, no matter how well-tuned the machine.

The key to cutting piano hinges

Q: I need to cut a section of piano hinge for a cabinet door, and the last time I did that the rod fell out. What should I do differently this time?

—Tom Lendway, Vadnais Heights, Minn.

A: If you look closely at the hinge knuckles, Tom, you'll see a dimple every few inches. The manufacturer adds these to put just enough pressure on the rod so it won't slide out. If you cut a piece so short that it contains no dimples, or maybe only one, use a small-diameter punch and a hammer to add a couple dimples.



It took a couple of firm hammer blows on this pointed punch to form a dimple that holds the piano hinge rod in place.

Got a question?

If you're looking for an answer to a woodworking question, write to **Ask WOOD, 1716 Locust St., GA-310, Des Moines, IA 50309-3023** or send us an e-mail at **askwood@mdp.com**. For immediate feedback from your fellow woodworkers, post your question on one of our woodworking forums at **woodmagazine.com**.

Select The One That's Right For You

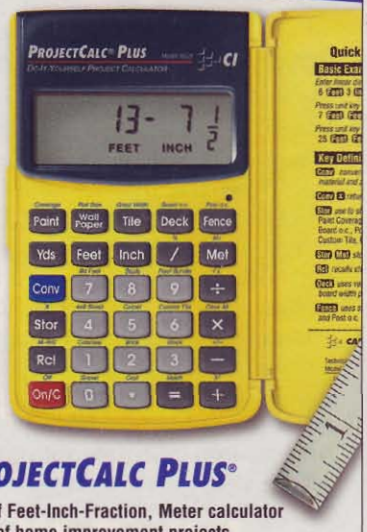
Save Time and Money — Eliminate Errors and Frustration

Work in and convert between Feet-Inch-Fractions and Meters.

Solve Linear, Area and Volume measurements.

Find project material quantities.

Get the job done right; the first time!



CONSTRUCTION MASTER®

Advanced Feet-Inch-Fraction construction math for Pros; cut costs, errors and rework — produce job winning estimates and bids.

- Work in and convert between dimensions, including Metric
- Instantly calculate Area and volume; Circles
- Built-in Right-Angle solutions
- Complete Stairs: Risers, Treads and Stringers
- Complete Rafter and Framing solutions
- Automatic Block count and Footing volumes

Available where fine tools are sold.

PROJECTCALC PLUS®

Do-It-Yourself Feet-Inch-Fraction, Meter calculator solves 100's of home improvement projects.

- Wallpaper — coverage by Area or per roll
- Paint — Pints, Quarts, Gallons for an Area; or Area per Gallon
- Tile — coverage in standard or custom sizes; including grout
- Fence — Boards, Posts, Rails for any spacing and distance
- Deck — boards for any width on center
- Many, Many More!

Available at Home Centers and Hardware Stores Everywhere.

Or to locate a dealer near you, call Toll-Free 1-800-854-8075

CALCULATED INDUSTRIES® www.calculated.com

WD-901

shop-proven products

These woodworking wares passed our shop trials

Drum sanders: one upgraded, one downsized

The name Performax has become synonymous with affordable drum sanders, and two new machines solidify that reputation. One model, the 22-44 Plus, received an upgrade, while a completely new model, the 10-20 Plus, adds a smaller sander to the line at a low-end affordable price.

The 22-44 Plus (so named because its drum has the capacity to sand a 22"-wide panel or workpiece in one pass, or a 44" piece in two passes) now features an electronic speed control on the conveyor belt. Called "SmartSand," its circuitry senses when the drum is bogging down and automatically slows the feed rate to allow the drum time to do its work.

This slowing down and speeding up caused minor inconsistencies in sanding depth on the first 36" panel I made, but another quick pass through the 22-44 Plus, without adjusting the drum height, evened it out nicely. (A red LED indicates when SmartSand is working, so to avoid those inconsistencies on the next panel, I manually slowed the belt until the LED went out to achieve optimum speed.)

10-20 Plus

The 22-44's new baby brother—the benchtop 10-20 Plus—has all the features of the big machine except for SmartSand. And, although its 7-amp motor pales in comparison to the stout 18.5-amp, 220-volt motor of the big sander, it's plenty for the 10" capacity of this unit. Using 100-grit abrasive, I found I could remove a comfortable 1/64" from 10"-wide red oak shelves. Deeper cuts, however, tripped the breaker on the drum motor. Most home woodworkers will find that the 10-20 Plus offers enough power and capacity for 90 percent of their sanding tasks.

—Tested by David Stone

Performax 22-44 Plus

Performance	★★★★★
Price	$1,100 as shown; subtract $100 for benchtop model, or add $100 for closed-base stand

Performax 10-20 Plus

Performance	★★★★☆
Price	$500

WMH Tool Group
800/334-4910; wmhtoolgroup.com

Power sharpener somehow proves irresistible

The Veritas MKII Power Sharpening System has almost as many low points as high points. Yet, during months of testing, I found myself drawn to it almost every time I entered the shop. With it, I sharpened plane blades, chisels, cabinet scrapers, and more. All of my lathe tools got a taste of the machine, from bowl gouges to skews.

Instead of stone grinding wheels, the MKII sharpens with self-adhesive abrasive discs mounted on two quick-change 8" platters. The platter for the two finest grits is thinner than the coarse platter, automatically creating a microbevel without having to change the height of the tool rest.

Changing platters couldn't be easier: Remove the center screw, replace (or flip) the platter, and then reinstall the screw. That screw isn't reverse-threaded as I expected, and the instructions that came with the MKII say the design allows the platter to spin freely in the event a tool should "catch" while sharpening. However, the platter loosened under aggressive sharpening pressure, and I found myself stopping time and again to retighten that screw.

The somewhat stiff 80- and 150-grit abrasive discs mount easily to the platter, but I had trouble applying the thin-backed 320- and 1200-grit discs without trapping air bubbles, even after several months of working with the MKII. And popping and flattening the bubbles, as the instructions suggest, proved problematic. (On one occasion, a bench chisel I was sharpening caught on one of these flattened bubbles and flew about six feet.)

In spite of its shortcomings, the MKII has found a permanent place in my shop. It's an aggressive sharpener that put a keen edge on virtually every tool I could find, but it must be used with care.

—Tested by Steve Oswalt

Veritas MKII Power Sharpening System

Performance	★★★☆☆
Price	$300

Lee Valley Tools
800/871-8158; leevalley.com

Continued on page 116

X marks the spot on laser-guided drill press

Lasers keep popping up on tools like weeds, and the latest Craftsman power tool to sprout a bright red light sight is the 22925 Drill Press with LaserTrac. This floor-standing machine sports a pair of laser lines that cross to show exactly where the bit will enter the wood, as shown at *right*.

Once aligned (a one-time job that requires a fair amount of patience), the crosshair is remarkably accurate, and remains so regardless of the distance between the laser and the workpiece. The lasers can't project around some bits, such as large Forstners and holesaws, but with twist and brad-point bits, I liked seeing exactly where the bit would hit without trial-and-error "tapping" the tip of the bit on my mark.

Even without the laser sight, the 22925 has some great features, such as a work-piece support (similar to the extension rods on some mitersaws) that extends up to 12" from one side of the cast-iron table. Left-handed woodworkers will appreciate the quill feed handle that mounts on either the right or left side of the machine.

Those features would be meaningless on a wimpy or undersized drill press, but the 12-speed 22925 has ample power for any bit or holesaw I used in hardwoods. I found the threaded-rod depth stop reliable with no change in depth after boring more than 100 holes with a ½" twist drill bit.

If you like the laser but already have a Craftsman drill press, Sears also sells the LaserTrac collar (part no. 24042) as an add-on accessory for $40. Craftsman's Web site lists some of the models it fits.

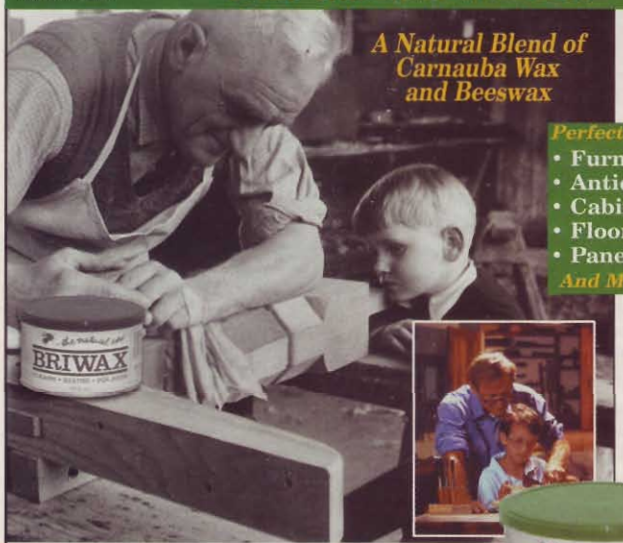
—Tested by Larry Christensen

Craftsman 15" Drill Press with LaserTrac (22925)

Performance	★★★★☆
Price	$320

Available at Sears or craftsman.com

MY WAX...BRIWAX
FROM GENERATION TO GENERATION...
ONLY THE BEST WILL DO!



BRIWAX has been in my woodworking family for 3 generations. Now with 8 colors from which to choose, my grandfather would be jealous. Now my grandson can be as creative as he wants to be! Once you discover the **BRIWAX** difference you will join countless other woodworking professionals who declare... "My Wax... **BRIWAX**".

www.briwax.com
or Call: 1-800-5BRIWAX

AVAILABLE IN CLEAR & 7 SHADES

Circle No. 55

WOW!
LOOK WHAT A TYPICAL TABLE SAW CAN DO.
Convert your table saw into a molder with the Magic Molder.

818.782.0226
A Division of:
LRH Enterprises, Inc.

9250 Independence Ave. Chatsworth, CA 91311 818.782.0226 or FAX 818.909.7602
Email: sales@lrhent.com Website: www.lrhent.com

Digital caliper saves wear on eyes and wallet

I'm not getting any older, but apparently my eyes are. They've slipped enough that lately I've been having trouble making out the tiny lines on my old vernier caliper. While I was shopping for a replacement unit, the MC0006 digital caliper from Avenger Products caught my eye.

The numbers on the MC0006's display read easily, because they're ⅜" tall—half again as large as those on other digital calipers I've seen. The display reads in millimeters or decimal inches, and is reliable to .0005". That's half of a thousandth of an inch! If you prefer a caliper that reads in fractions of an inch, Avenger's president Fred Gunzner told me that a fractional-reading model will be coming out soon.

The price helped seal the deal for me. Other digital calipers run about $65–$70, and some of those are made of plastic; the MC0006, made of heat-treated steel, sells for $40. I measured just about everything in my shop with both the Avenger and a more expensive digital caliper, and the measurements came out the same every time.

—Tested by Dave Campbell

Avenger MC0006 6" digital caliper

Performance	★★★★★
Price	$40

Avenger Products
805/983-0039; avengerproducts.com

Continued on page 118

WOW
24 Woodworker Piece Collection
This Set Contains A Great Selection of Bits
• 4 Straight Bits
• 2 Dovetail Bits
• 2 Chamfer Bits
• 1 Mortising Bit
• 1 "V" Groove Bit
• 2 Roundnose Bits
• 2 Cove Bits
• 1 Bevel Bit
• 1 Roman Ogee
• 1 Plunging Panel
• 1 Laminate Trim
• 4 Roundovers
• 2 Rabbeting Bits
24 Great Bits
ONLY $75 Order NOW While Supplies Last
WL-2006 - 1/2" Shank
WL-2005 - 1/4" Shank
DELUXE 6pc FLUSH TRIM SET
3 Two Flute Bits with 1", 1-1/2", 2" Length
AND
3 Three Flute Bits with 1", 1-1/2", 2" Length
ONLY $45
WL-1206-6 • 1/2" Shank
4 Pc Roundover Set
1/8", 1/4", 3/8", and 1/2"
ONLY $20.00
WL 2024-1 is 1/2" Shank
WL 2024 is 1/4" Shank
DON'T MISS THIS! SALE
WOODLINE USA
WOOD01 SALE CODE
CALL 1-800-472-6950
LOG ONTO WOODLINE.COM
WOOD01 SALE CODE
Deluxe Router Bit Storage Stand
Keep Your Bits Handy With This Maple Stand With Thick Foam Lining Great For Customizing Drawers In You Table
WL RBS $15.00
END OF SALE SUMMER BLOWOUT SALE
TOP QUALITY CARBIDE CUTTERS AT THE LOWEST PRICES EVER!
ACT NOW! SALE ENDS 10/01/04
Holds 66 Bits
The Perfect Storage Solution For Your Growing Collection Holds Up To 66 Mid-Size 1/2" Shank Router Bits And Can Be Easily Adapted For 1/4" Shanks With Standard 1/2" OD 1/4" ID Tubing
WL 2064 $20.00
INCREDIBLE 66 Pieces
Signature Series by WOODLINE USA
Master Woodworking Collection
$219 NOW $189
WL-2066 for 1/2" Shank or WL-2065 for 1/4" Shank
• 14 deg 3/4"
• 14 deg 5/8"
• 8 deg 1/2"
• 14 deg 1/2"
• 14 deg 3/8"
5pc Dovetail Kit $19
WL 2017 1/2" Shank
Make Perfect Dados Every Time!
This Set Includes
9 Two Flute Straight Bits
Undersized for Plywood
Standard for Hardwoods
Oversized for Melamine or Veneered Materials,
In 3 Popular Sizes
1/4", 1/2" & 3/4"
9pc MASTER DADO SET
WL 2030 1/2" Shank $39
Check Out The NEW
WOODLINE.COM
Order Everything Online With Our Deluxe Cart System
New Easy To Use Format
Join Our E-Family Today
Full Online Product Catalog
Smart Search System To You Find What You Need
ORDER ONLINE TODAY AND ENTER SALE CODE WOOD01
CALL 1-800472-6950 OR LOG ONTO WOODLINE.COM TODAY! TO ORDER OR TO RECEIVE A FREE CATALOG - WOODLINE USA • 111 Whee er St • La Vergne, TN 37086

Circle No. 310

CH compressor is cordless, compact, and quiet

My pneumatic brad nailer saves me a lot of time on big finish-carpentry jobs. But for small tasks, such as trimming out a single window, dragging an air compressor (or even just the hose) through the house is more trouble than it's worth. For those quick jobs, Campbell-Hausfeld's 20-pound FP2400 cordless air compressor is just the ticket, providing adequate air without the entanglements of a cord or long hose.

To test the FP2400, I hooked it up to my 18-gauge brad nailer using the included 25' recoil hose, and started driving 1¼" brads into oak. As regular as clockwork, the compressor motor kicked on after every second fastener to replenish the air storage tank (with a purr noticeably quieter than tankless "inflators"). It took six seconds to top off the tank—a bit longer than it took me to reposition the nailer for the next shot.

Pushing the oil-free FP2400 to its limits, I drove one fastener every second for ten seconds, and found that the sixth brad was set just flush with the surface, while brad number ten stood about ⅛" proud. It's simply not designed for rapid-fire production work, nor the high air demands of a roofing or framing nailer.

Alternating motor "run" and "rest" times of five minutes, I averaged just under an hour of run time before exhausting the internal battery. At this point, I was out of business for about eight hours: The compressor won't run while the FP2400 is plugged into a wall outlet, and it takes that long to recharge the battery. Still, for woodworkers who want the convenience of an air nailer without the expense, the FP2400 provides the power.

—Tested by Jeff Hall

FP2400 Cordless Compressor

Performance	★★★★☆
Price	**$110 (includes hose, tire chuck, fittings, and wall-mounting bracket)**

Campbell Hausfeld
888/247-6937; chpower.com

About our product tests

We test hundreds of tools and accessories, but only those that earn at least three stars for performance make the final cut and appear in this section. Our testers this issue include: high-school woodworking teacher **Jeff Hall**, computer systems analyst **Larry Christensen**; and *WOOD*® magazine staff members **Dave Campbell** (tools editor) and **David Stone** (techniques editor), and sharpening consultant **Steve Oswalt**. All are avid woodworkers.

what's ahead

A sneak peek at just some of the articles in the October issue (on sale August 31)

Projects for your home and shop

Mission-style bed

Build this bed as a twin, queen (shown), or king, and then watch following issues for the matching nightstand, dresser, and hope chest.

Go-anywhere tool cabinet

This tote stores all of your job-site tools and has wheels and a pop-up pull handle to go where you need it.

Coin-gobbling bank

Kids will love feeding money to this friendly giraffe, and they'll love you for making it.

Chef's choice spice rack

This weekend project has the *Better Homes & Gardens*® Test Kitchen seal of approval.

On-the-mark mortising gauge

Make this handsome tool from a few scraps of wood, and then learn to put it to effective use in your shop.

Tools & Techniques

6×48" belt/disc sanders

We found big performance differences between 10 similar-looking sanders priced from $400 to $800.

Workshop workover

See our two-day $1,000 reader-shop redo; then crib the ideas to make a few improvements of your own.

Hand-plane primer

Award-winning woodworker Randy Miller shares his secrets for choosing, adjusting, and using this essential tool.

Gear up for glue-ups

Avoid gluing foul-ups, such as excess squeeze-out or misaligned project assemblies, by using these tips.

Better Homes and Gardens® *WOOD*® magazine (ISSN-0743-894X) is published seven times a year in March, May, June/July, September, October, November, and December by Meredith Corporation, 1716 Locust St., Des Moines, IA 50309-3023. For subscription questions call 800/374-9663. Periodicals postage paid at Des Moines, Iowa, and additional mailing offices. Better Homes and Gardens trademark registered in Canada and Australia. Marca Registrada en México. One-year subscription prices: U.S. and its possessions, $28; Canada, $41; other countries, $49. Canada Post Publications Mail Sales Product Agreement No. 40069223. Canadian BN 12348 2887 RT. CANADIAN RETURN ADDRESS: Better Homes and Gardens WOOD magazine, 2744 Edna Street, Windsor, Ontario, N8Y 1V2. POSTMASTER: Send address changes to Better Homes and Gardens WOOD magazine, P.O. Box 37439, Boone, IA 50037-0439.